

**THE PRIMARY COPPER INDUSTRY
OF ARIZONA
IN 1989**



DEPARTMENT OF MINES AND MINERAL RESOURCES

BY RICHARD R. BEARD

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Cover: Copper cathodes from Ray's SX-EW plant.



**STATE OF ARIZONA
DEPARTMENT OF MINES AND MINERAL
RESOURCES**

Leroy E. Kissinger, Director

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OF ARIZONA IN 1989**

Special Report No. 16

by

Richard R. Beard, Mining Engineer

October, 1990

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* Throughout this report a "ton" means a short ton (2,000 pounds or 0.90718 metric ton).

Specific statistics may vary slightly from table to table due to differences in source data.

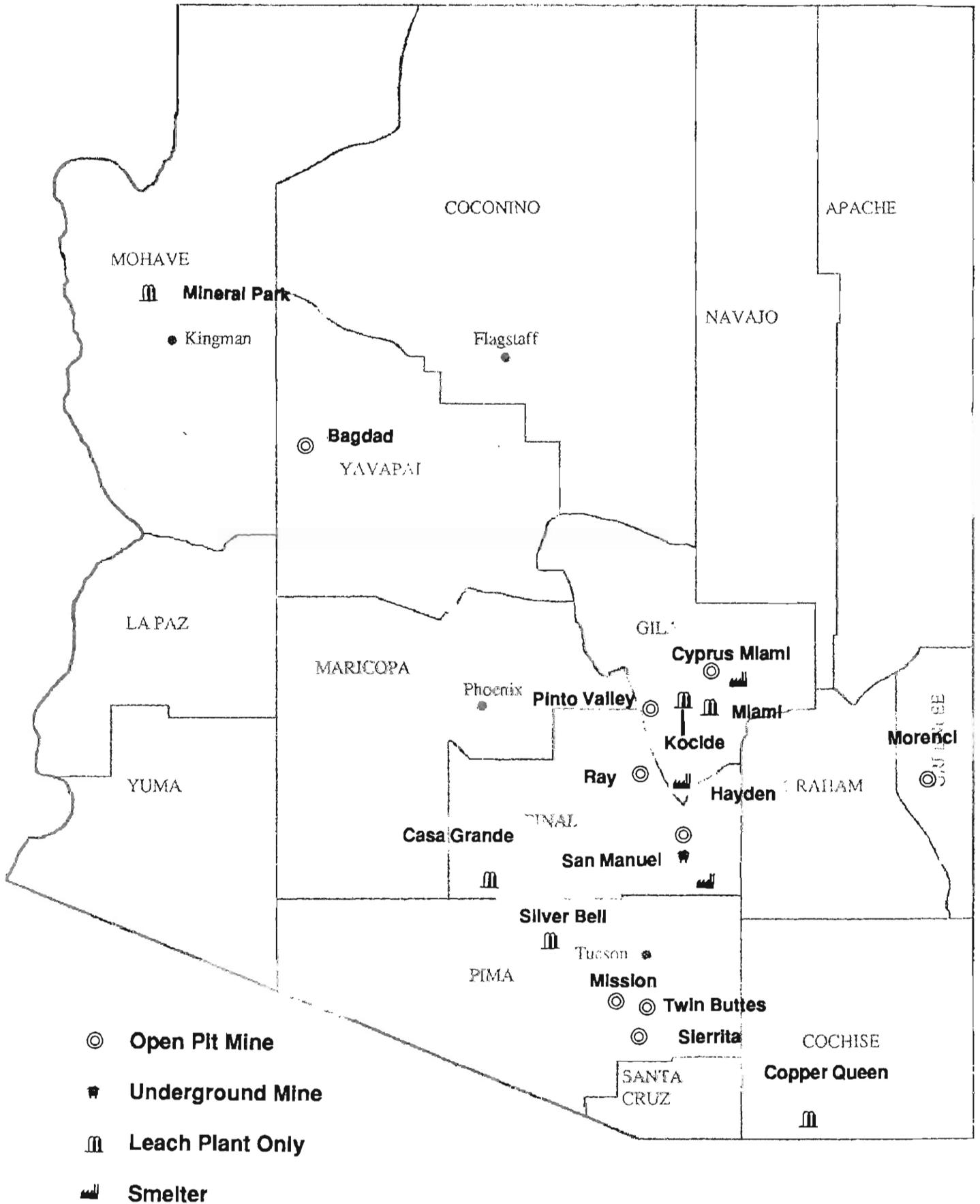
INTRODUCTION

The Arizona Department of Mines and Mineral Resources presents herein a report covering activity in Arizona's copper industry in the calendar year 1989. A brief review of operational highlights reported by the major developers and producers in the State, market and price developments that affected copper production, and discussions of Arizona severance taxes on metalliferous minerals are included.

The contained statistical tables include various production, employment, inventory, import/export, prices, costs, and ore reserve numbers for 1989. Production of recoverable copper is given for individual mines and by company. Figures showing the importance of copper in the mining industry are provided, as are data on the by-products of copper mining; gold, silver, and molybdenum. In addition, historical compilations are included for leach copper, average grade of ore produced, percent copper recovered, open pit mine stripping ratios, and employment and earnings. Additional compilations indicating refined copper inventories in and out of the United States and average copper prices by month from 1980 through 1989 are provided. Also included are tables showing designed mine capacity and copper reserves in Arizona plus average copper cash production costs for the United States, 1983-1988.

The Department maintains extensive reference libraries in its Phoenix and Tucson offices concerning the copper industry in Arizona. These repositories include information on individual mines and mining companies, United States Bureau of Mines and United States Geological Survey publications, other professional publications, periodicals, and earlier editions of this report. Additionally, experienced mining engineers are available for consultation, at no charge, on matters germane to the minerals industry. Office hours are 8 a.m. to 5 p.m. on all non-holiday weekdays in Phoenix and on Mondays and Tuesdays in Tucson.

**Figure 1. PRODUCING COPPER PROPERTIES
1989**



1989 OPERATIONS SUMMARY

| | |
|--|--|
| Operating Properties | 14 |
| Operating Companies | 6 |
| Operating Smelters | 3 |
| Ore Mined (including some oxide) | 196,684,000 tons |
| Ore Milled (sulfides) | 158,920,000 tons |
| Waste/Overburden removed (includes some leach material) | 261,941,000 tons |
| Average stripping ratio | 1.46:1 |
| Copper produced | 1,004,891 tons - 60.8% of U.S. |
| From sulfide ores | 754,556 tons - 75.1% of AZ |
| Average grade | 0.62% copper |
| From leaching | 250,335 tibs - 24.9% of AZ |
| SX-EW | 237,667 tons - 94.9% of leached 23.7% of total |
| Precipitation | 12,668 tons - 5.1% of leached |
| Molybdenum produced | 29,795,000 pounds |
| Silver produced | 4,926,600 troy ounces |
| Gold produced | 69,000 troy ounces |
| Average employment | 11,111 |
| Average annual wage | 34,488 |
| Productivity (production workers) | 118 lb. of copper per man-hour, 11.6 tons of ore per man-hour |

COPPER PRODUCTION IN ARIZONA - 1989

Arizona's copper industry produced 1,004,891 tons of copper in 1989 (Table I). This is an increase of 6.7% above 1988, but is still 8.8% below the record production of 1981 (Table IX). Arizona's share of the United States total was up to 60.8% from 59.5%.

The gross value of non-fuel mineral production in Arizona in 1989 was up 15% above 1988 to \$3,190,266 (Table X) as copper prices remained firm. Copper production represents 81.3% of this total; the by-products of copper production (gold, silver and molybdenum) represent an additional 4.8% (Table IX). The total contribution of the copper mines was therefore 86.1% of the gross value.

Copper was produced by 6 companies from 14 properties in 1989 and molybdenum was recovered as a co-product or by-product at 5 of these properties (Tables III & IV). Eight properties produced 98.9% of Arizona's copper and 3 produced 89.4% of the molybdenum. The Morenci-Metcalf mine of Phelps Dodge led in copper production with 30.1% of the total. The Sierrita- Esperanza complex produced 50.0% of the molybdenum.

More than 250,000 tons of copper representing 24.9% of the total was produced by leaching in 1989. Solvent extraction-electrowinning produced almost 238,000 tons of cathode copper from these leach solutions. The remaining 12,000 tons were precipitated as cement copper (Table I).

Stripping of waste, including some leachable material, was accomplished at the 9 operating open pit mines during 1989. The weighted average of the stripping ratios - waste to ore -

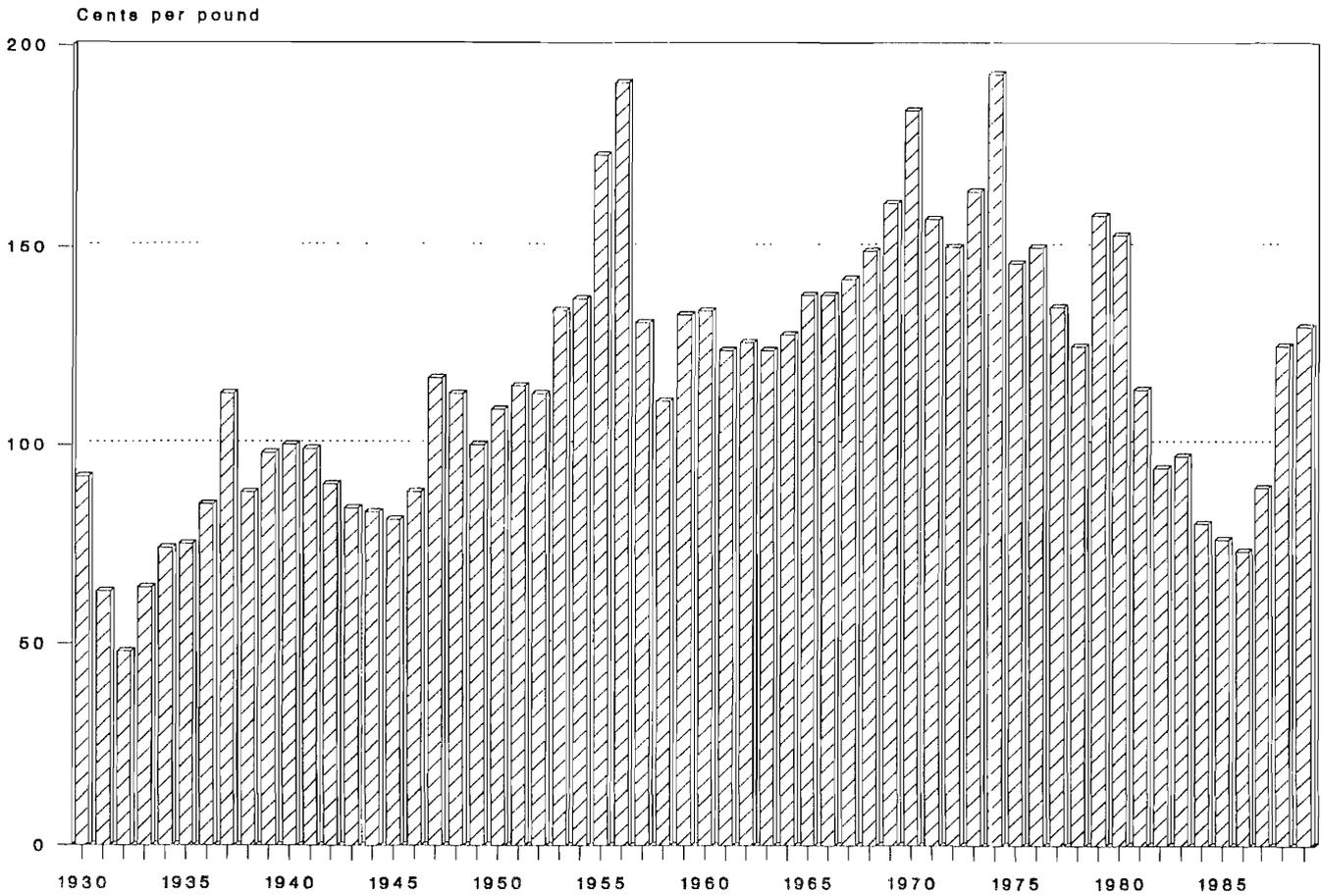
was 1.46 to 1 (Table VIII). This is comparable to the 1.49 to 1 in 1988 which probably indicates continued normal long range mine planning.

The weighted average grade - percent copper - of sulfide ores mined in 1989 was 0.62% copper (Table VI).

The estimated capacity to produce copper at each of Arizona's principal operations totals 1.131 million tons annually (Table XI). By this estimate the mines, concentrators, and leach facilities operated at 88.8% of capacity in 1989.

The copper reserve base in Arizona by company and property is estimated in Table XIII. The reserve base as defined in "Mineral Facts and Problems" 1985 Edition, Bureau of Mines Bulletin 675, page 3, includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently sub-economic (sub-economic reserves). The many technical, political, social, and economic variables render a listing of actual economic reserves inappropriate.

**Figure 2. COPPER PRICE
IN CONSTANT 1989 DOLLARS**



| | | | | | |
|-------------------------|---------------------------|-------------------------|-----------------------------|--------------------------------|--------------------|
| 1930's | 1940's | 1950's | 1960's | 1970's | 1980's |
| Average: \$0.86 | Average: \$0.91 | Average: \$1.28 | Average: \$1.30 | Average: \$1.49 | Average: \$0.95 |
| The Great Depression | Wartime Price Controls | Peace and Prosperity | Viet Nam & Social Unrest | Energy Crisis & Stagflation | Recession |

Source:

U.S. Gross National Product Deflator Price Index - U.S. Bureau of Economic Analysis

U.S. Producer Price Index of Intermediate Materials for Durable Manufacturing - U.S. Bureau of Labor Statistics

U.S. Consumer Price Index (CPI) - U.S. Bureau of Labor Statistics

Historic Prices - Metals Week: Copper, Wire Bars

As reported in *Non-Ferrous Metal Data, 1983* and *1989*, American Bureau of Metal Statistics

STATUS AND PROGRESS

The recovery of the copper market that began in 1987 continued through 1989. This fact coupled with the improvements in operating efficiencies and the application of improved technology, which were initiated to survive the disastrous market conditions of the mid-eighties, made 1989 a profitable year for Arizona's copper industry.

In spite of the political and labor difficulties that plagued some of the major foreign producers, world mine production increased during the year. However, this increase in production was mostly offset by an increase in consumption. World stocks of refined copper were up by 63,000 short tons (16%) but were still only about of those reported in the mid-eighties. U.S. stocks were down slightly from 1988.

The utilization of capital to increase production and decrease costs at existing operations, as opposed to the development of new ore bodies, remained

the dominant investment philosophy in 1989. Asarco continued the modernization and expansion of production at its Mission and Ray units. Cyprus increased production at Sierrita by adding higher grade ore from Twin Buttes to the concentrator feed. Magma increased recovery at Pinto Valley by the addition of flotation cells in the concentrator. At Miami the leaching of the old Miami Copper Company tailings got underway. Phelps Dodge christened the In Pit Crushing and Conveying (IPCC) system and doubled its SX-EW capacity at Morenci.

At the smaller properties Kocide ceased operations at the Van Dyke. (In July, 1990 it was announced that Arimetco had inquired the Van Dyke from Kocide). Arimetco produced copper precipitate at Emerald Isle and started con-

struction of an SX-EW plant at the Johnson Camp property which is scheduled for production in 1990.

OPEN PIT MINING

The majority of the copper is produced by open pit mining methods. So far most of the improved efficiency has been the result of consolidation, preplanned maintenance, scheduling and utilization of equipment. The computer dispatching at Morenci is but one example of this. Now, however, major changes in operating methods are being instituted.

At Morenci, Phelps Dodge has gone from an all rail haulage system, through an interim system using trucks to service the shovels and haul to in-pit transfer points for rail haulage to the concentrators, to the In Pit Crushing and Conveying system (IPCC).

Cyprus has acquired the Twin Buttes property to provide additional feed to the Sierrita mill as well as oxide ore for the Twin Buttes Oxide plant.

Magma's Pinto Valley division has started slurrying the old No. 2 tailings at Miami, leaching them and redepositing them in the mined out Cities Service Pit.

UNDERGROUND MINING

San Manuel was the only operating underground mine in Arizona during 1989. Development of the Kalamazoo ore body at San Manuel was resumed during the year. Also the Magma Mine at Superior has been dewatered and rehabilitated for production to begin in mid 1990.

Development of Asarco's underground orebody at Sacaton and Phelps Dodge's Safford property has been suspended indefinitely.

IN-SITU MINING

In-situ leaching of rubbleized copper bearing material remaining in mined out underground stopes has long been practiced in Arizona. At San Manuel, Magma is developing a more formalized program of leaching mined out block caving stopes and is approaching production status. During the last few years all of the production from the Lakeshore property has been from a similar system developed by Noranda. Cyprus is continuing this project as well as tests of in-situ leaching of non-rubbleized or virgin ground.

The U.S. Bureau of Mines is funding tests of in-situ leaching of virgin ground in Arizona. Science Applications International Corporation has been awarded a contract to identify analytical procedures and develop computer algorithms that could be used to select the best in-situ mining method for any specific copper oxide deposit. Asarco is cooperating with the Bureau at the Santa Cruz property near Casa Grande. The Santa Cruz ore body is a deep seated acid soluble deposit which is owned by Asarco and Freeport McMoran on a 50-50 basis.

SOLVENT EXTRACTION

Traditionally the copper produced from leach solutions has been extracted by cementation process (precipitation from solution by the replacement of copper in solution by metallic iron). This has been a source of relatively cheap copper, but the cement copper produced must be smelted and refined along with the flotation concentrates.

During the 1960's, Ranchers Exploration and Development Corporation pioneered the use of solvent extraction-electrowinning to produce copper from its Bluebird property near Miami. The obvious advantage of this method is that cathode copper of salable quality can be produced directly from leach solutions. Smelting, with its pollution problems, and further refining are therefore not required.

During the relatively good years experienced by the industry after Rancher's introduction of solvent extraction-electrowinning, interest in the process grew gradually. The disastrous 80's prompted an accelerated interest in it, however. Twelve plants operated during 1989. Several expansions or new plants are planned and the cementation process is being phased out except as a subsidiary method.

CONCENTRATION

The overwhelming majority of copper mineralization in Arizona is of the sulfide type and is not amenable to leaching without extraordinary means. Inspiration has had success with its heap leach-ferric cure process on mixed oxide-sulfide ores and Kennecott pioneered the use of bacteria to convert sulfides to oxides in low grade dumps. However, as shown in Table I, about 75% of the copper was produced by the flotation method of concentration. In addition much of the leached copper produced is from dumps of "waste" that was stripped from open pit mines to provide access to sulfide ore. Another aspect of the flotation process that makes it viable at some properties is the recovery of molybdenum by selective flotation. Molybdenum provides a significant portion of the revenues from some properties. Also, any precious metals in the ore follow the copper through the flotation process and smelting to

the electrolytic refinery where they can be recovered from the anode slimes.

There are currently eight flotation concentrators in operation in Arizona. Asarco is operating 2 - Ray and Mission, Cyprus is operating 2 - Bagdad and Sierrita, Magma is operating 2 - San Manuel and Pinto Valley, and Phelps Dodge is operating 2 at Morenci-Metcalf. Six are on standby; Magma's at Superior, Asarco's at Silver Bell, Cyprus' at Mineral Park, Esperanza, and Miami, and Phelps Dodge's at Ajo.

Although efficiency is constantly being improved, the flotation process is not cheap. It requires crushing and grinding the ore, separation of the ore minerals from the gangue minerals in the flotation cells, smelting the concentrate, and refining the copper anodes from the smelter. The most significant development in flotation is the column flotation cell being installed in most concentrators.

SMELTING

Of the six smelters remaining in Arizona in 1989 only three operated. Asarco's Hayden smelter and Cyprus' smelter at Miami have been brought into compliance with air pollution constraints and Magma's smelter at San Manuel has been retrofitted with an Outokumpu flash furnace to bring it into compliance. The Ray smelter at Hayden that Asarco acquired from Kennecott met all significant environmental constraints when last operated in 1982 and is available if needed. Phelps Dodge's smelters at Ajo and Morenci will require extensive retrofitting before they can be operated. Phelps Dodge is shipping concentrates to its Hidalgo smelter at Playas, New Mexico and to the Chino smelter at Hurley, New Mexico that was recently acquired from Kennecott. Excess concentrates are being sold.

As an alternative to smelting, Cyprus Casa Grande has reactivated the Roast-Leach-Electrowinning (RLE) plant built by Hecla at the Lakeshore property. In this process flotation concentrates are roasted to make them acid soluble and leached with sulfuric acid. Soluble cathode copper is extracted from the leach solution by electrowinning. Cyprus is upgrading the leach solutions in the solvent extraction plant before electrowinning. Acid is produced from the roaster gases and the process is essentially pollution free.

A portion of the concentrates from Sierrita are being processed at this plant.

PROGNOSTICATION

With the continuation of the political and labor difficulties being experienced by foreign producers, 1989 was expected to be a good year for the copper industry. Its strength, however pleasantly surprised even the most optimistic expectations.

The outlook for 1990 is also good since these problems in South America, Africa, and the Philippines do not appear to be near resolution. However, the longer view is less optimistic. The new or increased production planned for the first half of the nineties in Portugal, Indonesia, and especially in Chile with Escondida, Disputada, Candalaria and Que Brada Blanca, will have a significant impact on the market. Should Peru, Zaire, Zambia, the Philippines and Papua New Guinea all resolve their political and labor problems during this period the impact on the market could very well be disastrous. This appears to be an extremely remote possibility, although one or two of them could make the grade.

To further confuse the issue the iron curtain nations are now trying to enter the real world. Although they are in possession of large reserves, their productive capacity has been throttled by their bureaucracy. If freed from governmental control the properties in these countries could be major producers of copper before the turn of the century. However, this production, and more could easily be absorbed by increased consumption within these countries. If they are freed to the extent that they can bring their entire economies up to be on a par with the west, consumption will increase dramatically. As with any abrupt change in the living conditions of a significant percentage of the world's population, there are likely to be short term disruptions in the copper market. Severe swings both up and down can occur but in the long run these changes in the worlds economics should prove to be beneficial.

Like all would be prognosticators, I have hedged predictions with numerous ifs and buts. Conditions will either get better, get worse, or stay the same. To be a bit bolder I'll say that, barring the event of a drastic recession, the short term outlook is positive, The decade of the nineties, however, is fraught with too many variables to be comprehensible to my biological computer. I certainly do not, however, expect a return to the "mining is dead" scenario that was foisted upon the industry by its detractors in the eighties.

ARIMETCO INCORPORATED

**Corporate Headquarters - 8835 East Speedway Blvd. Suite A, Tucson, Arizona 85710
Phone (602) 290-9200**

Arimetco acquired the Emerald Isle and Johnson properties in Arizona and the Yerington property in Nevada during 1989. The Yerington property has been put into production.

In June 1990, Arimetco acquired the Van Dyke property at Miami, Arizona.

Emerald Isle

**Kingman, AZ
Phone (602) 565-4554**

The Emerald Isle operation consists of in-situ leaching and a precipitation plant in production during 1989. Arimetco plan to install a SX-EW plant with a design capacity of 2 million pounds per year.

Johnson

**Benson, AZ
Phone (602) 586-2241**

In 1989, Arimetco acquired the Johnson property and started preparing it for production. Construction of a 35,000 pound per day SX-EW plant was started. The material on the previously leached dumps will be crushed, re-tacked and leached prior to the mining of new ore. Designed production capacity will be 9.5 million pounds of copper per year and is scheduled to start in 1990.

ASARCO INCORPORATED

**Corporate Headquarters - 180 Maiden Lane, New York, New York 10038 -
Phone (212) 669-1000**

In Arizona, Asarco operates copper mines at Sahuarita, Ray and Silver Bell and a copper smelter at Hayden. In Texas, they operate a copper smelter at El Paso and a copper refinery at Amarillo. They also hold major interests in MIM Holdings Limited, Mexico Desarrollo Industrial Minero, S.A. (MEDIMSA) and Southern Peru Copper Corp. (SPCC).

In June 1989 Asarco purchased 49.9% of a partnership formed by Montana Resources to own and operate the Continental Mine in Butte, Montana.

In addition to copper, Asarco mines and refines lead, zinc, gold and silver and produces coal, industrial minerals and chemical and manufactured products.

During 1989 Asarco continued its restructuring and modernization program including the 46% expansion at Mission that was completed in February. A three year, \$260 million project to increase production by 40% is planned for Mission, Ray and El Paso. Scheduled for completion in 1992, this expansion will make Asarco independent of outside sources of feed for its smelters.

As a part of this project, \$30 million will be spent to retrofit the reverberatory furnaces at El Paso with Con Top smelting units manufactured by KHD of West Germany.

**Tucson Office - 1150 N. 7th Ave., P.O. Box 5747, Tucson, Arizona 85703 -
Phone (602) 792-3010**

The Tucson office houses the Southwest Mining Department, the Mining Department/Corporate Office, the Mineral Beneficiation Department, the Exploration Department, the Acid Sales Department and the Department of Safety and Technical Employment.

During 1989 Asarco's Arizona operation consisted of a major copper smelter at the Hayden Unit, major open pit mines at the Mission and Ray Units, and a dump leaching/cementation operation at the Silver Bell Unit. With the increased production at the Mission Complex, Asarco is able to produce 67% of the feed to its smelters.

Asarco and Freeport McMoran formed the Santa Cruz Joint Venture managed by Asarco. It is participating with the U.S. Bureau of Mines in an in-situ leaching experiment at the Santa Cruz deposit seven miles west of Casa Grande. This large deep seated deposit will be used to determine the feasibility of in-situ leaching of undisturbed virgin ground and to develop a data base for application to other suitable deposits. Hydrologic studies will be followed by the design and development of the leach field and the design of the pilot solvent extraction-electrowinning (SX-EW) plant. In December, 1988 the Joint Venture bought the adjacent Casa Grande deposit that added 300 million tons of reserves. Asarco also holds major reserves at the Chilito north of Hayden, at Helvetia, east of the Mission Complex and at Sacaton East.

Hayden Unit

Box 98, Hayden, Arizona 85235 - Phone (602) 356-7804

The Hayden Unit consists of an INCO flash furnace smelter rated at 940,000 tons of charge

per year for an estimated production of 175,000 tons of blister copper. An acid plant rated at 2,800 tons of sulfuric acid per day keeps sulfur dioxide emissions within air quality restraints.

By 1992, when Asarco's expanded and modernized copper facilities are operating at capacity their output will be enough to provide all the feed to its smelter.

Mission Unit

Box 111, Sahuarita, Arizona 85629 - Phone (602) 791-2920

The Mission Unit consists of the consolidation of the Mission, Eisenhower, San Xavier, and Pima open pit mines into one large open pit referred to as the Mission Complex. Also included is the smaller San Xavier North pit. The acquisition of the rest of the Eisenhower in April and of the Mineral Hill deposit adjacent to the Pima section of the open pit late in 1987 increased reserves and facilitates further efficiencies in pit design and mine planning.

Mining is conducted by electric shovels with truck haulage to the primary crusher and waste dumps. Some areas of the pit are back to final limits allowing some waste dumping in pit. The stripping ratio in 1989 was 1.41:1, waste to ore.

The concentrator capacity was increased from 29,000 tons per day to 41,000 tons per day during 1988. This was accomplished by lengthening the 10.5 foot diameter ball mills from 15 feet to 18 feet, installing 2 new ball mills salvaged from the Sacaton mill, converting some of the cleaner flotation cells to roughers and installing six 8x52 foot column flotation cells for cleaners.

Asarco exercised its option to purchase the Pima Mill at the Mission Complex which will

add 19,000 tons per day milling capacity. Of the \$260 million capital spending program, \$100 million is earmarked to refurbish this mill and expand mining capacity to feed it by mid-1990.

Ray Unit

**P.O. Box 9, Hayden, Arizona 85235 -
Phone (602) 356-7811**

The Ray Unit consists of an open pit mine, dump leach and heap leach operations, and a 40,000 ton per year SX-EW plant at Ray and a 26,000 ton per day concentrator at Hayden. The 400,000 ton per year smelter and 900 ton per day acid plant at Hayden are on stand-by status.

Mining is conducted by electric shovels supplemented by front-end loaders utilizing truck haulage. The production rate is 100,000 tons per day of which 26,000 tons are sulfide ore sent to the mill, and 10,000 tons are silicate ore that is crushed and sent to the leach heaps. The remainder is low grade sent to leach dumps or waste sent to waste dumps. The stripping ratio in 1989 was 1.70:1, waste to ore. The mine plans are predicated on the sulfide operation and therefore silicate ore is stockpiled when in excess and fed from the stockpile to the crushers when short.

Sulfide ore is hauled by truck to the primary crusher at Ray where it is crushed and transferred to trains for the 20 mile haul to the mill.

Silicate ore is hauled to the primary crusher then further reduced to minus 3/4 inch by secondary and tertiary crushers. It is then transported by conveyor where it is agglomerated with sulfuric acid while in transit to the heap leach area. Final haulage and placement on the heaps is by end-dump trucks.

Low grade muck is hauled to prepared leaching areas and non-mineral muck is hauled to

waste dumps by end dump trucks. All leach solution are now fed to the SX-EW plant.

Previously stockpiled native copper ore is being reclaimed and fed to the mill in small proportions as is smelter slag.

A \$12 million project was started in 1988 to maintain production capacity as the hardness of the ore increases as the pit deepens. In addition, \$130 million of the \$260 million expansion project will be spent at the Ray Unit. A 60,000 ton per day portable in-pit crusher and conveying system will replace the 30,000 ton per day primary crusher at the pit and a 20,000 ton per day concentrator will be built at the mine site. Concentrates will be hauled by rail to the smelter at Hayden. The project is scheduled for completion in 1992.

Silver Bell Unit

**Marana, Arizona 85653 - Phone (602)
622-6551**

The Silver Bell Unit consists of an open pit copper mine and an 11,000 ton per day concentrator that are both on stand by status. The dump leaching operation and precipitation plant are in operation. Reactivation of the mine and mill is under consideration.

CYPRUS MINERALS COMPANY

**Corporate Headquarters - 9100 E.
Mineral Circle, P.O. Box 3299,
Englewood, Colorado 80112 - Phone
(303) 643-5000**

Cyprus has continued to grow. In March 1988 it entered into a 15 year lease of the Twin Buttes property formerly operated by Anamax and in July 1988 they acquired the entire Inspiration property at Miami including the mines, con-

acid plant, electrolytic refinery, and rod plant. Cyprus was the second largest producer of copper in 1989 and continued to be the largest producer of molybdenum.

In addition to its copper-molybdenum properties, Cyprus operates Arizona's largest gold mine, the Copperstone north of Quartzsite, and has entered into a joint venture agreement with Magma to explore the old Mammoth mine, which is a part of Magma's San Manuel property, as a possible gold operation. Cyprus would be the operating partner.

Cyprus has grown on a worldwide basis as well as in Arizona. It operates the Thompson Creek molybdenum mine in Idaho and in July, 1988 it acquired the molybdenum mine at Tonopah, Nevada.

In March 1989, Cyprus acquired the Warrenton Refining Co. in Truesdale, Missouri, a producer of copper ingot and wire bar from scrap. In February of 1990 the acquired MCR Products Inc. in Chicago, Illinois from Magma, a producer of high quality copper rod.

In Australia Cyprus owns a share of and operates the Gidgee, Selwyn and Moline gold mines and has a share of the Sheahan-Grants gold mine. In New Zealand it is developing the Golden Cross Project.

In 1989 Cyprus produced coal from 9 mines in Colorado, Kentucky, Pennsylvania, Utah, West Virginia and Wyoming; talc in Montana, Vermont, Alabama, and Spain; and barite in Georgia. With the acquisition of Foote Mineral Company in April of 1988 it became the major producer of lithium from salt brines in the Silver Peak facility in Nevada and in northern Chile.

Cyprus acquired the Reserve Iron Operation in northern Michigan in 1989. These facilities are being rehabilitated and are expected to be in production in 1990.

Cyprus Bagdad

**P.O. Box 245, Bagdad, Arizona 86321 -
Phone (602) 633-2241**

The Bagdad operation consists of an open pit copper-molybdenum mine, a 55,000 ton per day concentrator, a dump leach operation and an SX-EW plant. A \$21 million expansion program currently underway will add a fifth grinding line to the existing mill and increase production capacity 15 to 20 % by mid 1990.

Mining is conducted by electric shovels using truck haulage to the primary crusher and dumps. The stripping ratio in 1989 was 1.23 to 1, waste to ore.

The sulfide ore is transported from the primary crusher at the mine, a distance of 6,400 feet to the coarse ore stockpile at the concentrator, by conveyor belts. There it is crushed further, ground by autogenous and ball mills and copper and molybdenum concentrates are produced. Column cells are utilized in the molybdenum flotation circuit.

Dual process ore (sulfide ore with an unusually high oxide content) is placed in heaps and leached for 60 days before being sent to the concentrator.

Pregnant solutions from the leach dumps are collected behind dams and pumped to the SX-EW plant at approximately 1.8 grams of copper per liter. The barren solutions are returned to the dumps after the copper has been extracted.

Cyprus Casa Grande

**P.O. Box C-9, Casa Grande, Arizona
85222 - Phone (602) 623-1539**

The Casa Grande operation consists of an in-situ leaching operation and an SX-EW plant. The block caved stopes in the oxide orebody are being leached and development of a leaching operation in virgin ground is underway using high pressure pumps to inject sulfuric acid solution into holes drilled from the old underground workings. Pregnant solutions are collected in sumps underground and pumped to the SX-EW plant.

The roasters and acid plant of the Roast-Leach-Electrowinning (RLE) plant built by Hecla have been refurbished and are treating concentrates from Sierrita. The pregnant solutions go to the SX-EW plant and the acid produced from the roaster gases is used for the leaching operations.

Cyprus Miami

**P.O. Box 1559, Claypool, Arizona 85532
- Phone (602) 473-7150**

The Cyprus Miami properties consist of three open pit copper mines formerly called Inspiration Mines, a 24,000 ton per day concentrator that is currently on standby status, a 450,000 ton per year electric furnace smelter, acid plant, SX-EW plant, electrolytic refinery and a 135,000 ton per year rod plant.

The ore is mined at the rate of 50,000 tons per day with electric shovels and hauled by truck to high grade, low grade and waste dumps. The stripping ratio in 1989 was 0.96:1 waste to ore. Soon after Cyprus acquired the property the construction of the second, nearly identical, solvent extraction train was completed that in-

creased the capacity of the plant to 8,000 gallons per minute. The 25 cycle AC to DC motor-generators were replaced with modern rectifiers to increase the capacity and efficiency of the tank house. The cathodes from both the electrowinning and electrorefining sections are fed to the continuous cast rod plant to produce 5/16 inch copper rod on reels holding three and one-third miles of rod each.

Cyprus Mineral Park

**P.O. Box 6249, Kingman, Arizona 86401
- Phone (602) 565-2226**

The Mineral Park property consists of an open pit copper-molybdenum mine and a 15,000 ton per day concentrator that are both on stand by status. The dump leaching operation and the precipitation plant are in operation and some in-pit leaching is also being conducted.

Cyprus Sierrita/Twin Buttes

**P.O. Box 527, Green Valley, Arizona
85622 - Phone (602) 791-2950 & (602)
625-4800**

The Cyprus Sierrita property consists of an open pit copper-molybdenum mine, a 100,000 ton per day concentrator, a ferromolybdenum plant, a rhenium plant, a dump leaching operation, and an SX-EW plant. The Esperanza pit and 17,500 ton per day concentrator were inactive during 1988 with the exception of the crushers that were used to supplement the Sierrita mill crushers.

Mining is conducted using electric shovels and truck haulage to the crushers and dumps. The stripping ratio in 1989 was 0.77:1, waste to ore. Dump leaching and precipitation began in the early 1960's.

When production ceased at Johnson Camp the SX-EW plant was moved to Sierrita to replace the precipitation plant. Lead anodes, titanium cathodes, extractants and other equipment and reagents were brought from Battle Mountain and Anamax to complete the installation and startup.

Production was started at the Twin Buttes mine in 1988 providing additional feed to the Sierrita Mill. The stripping ratio in 1989 was 8.37:1. Construction of a 6.8 mile conveyor to transport sulfide ore to the Sierrita concentrator was completed in 1989. Twin Buttes contributed about one third of the copper produced at the Sierrita concentrator in 1989. The SX-EW plant at Twin Buttes is fed with solutions from leaching tailings.

KOCIDE CHEMICAL CORPORATION

Corporate Headquarters - 1508 N. VIP Blvd. Casa Grande, AZ 85222 - Phone (602) 836-0607

Kocide, a subsidiary of the Griffin Corporation of Valdosta, Georgia, operates a plant in Casa Grande that manufactures agricultural products. The cement copper from the Van Dyke was used to produce copper sulfate used in the manufacture of these products.

Van Dyke Mine

P.O. Drawer D., Miami, AZ 85502 - Phone (602) 473-2421

Production from the Van Dyke in-situ leaching project started in December, 1988. Initially Kocide injected sulfuric acid solution into the

old underground stopes and recovered pregnant solution from a production well. Cement copper was precipitated in Kennecott cones using shredded, detinned cans as the precipitant. The planned rate of production was 4,000,000 pounds per year.

The Van Dyke was acquired by Arimetco in June, 1990.

MAGMA COPPER COMPANY

Corporate Headquarters - P.O. Box M, San Manuel, Arizona 85631 - Phone (602)385-3100

In March 1987, after nearly 20 years as a wholly owned subsidiary of Newmont Mining Corporation, Magma once again became an independent corporation. As such it has continued implementing an extensive expansion and modernization program to meet all environmental constraints and to become competitive in the copper market. As part of this program the company housing in the town of San Manuel is being sold.

Magma's Arizona operations are divided into the San Manuel Division and the Pinto Valley Division which include the Pinto Valley Unit and the Miami Units. The original Magma Mine at Superior was closed in 1982 and remained inactive throughout 1988. However, dewatering and rehabilitation was commenced in 1989 and production is scheduled for mid 1990.

Magma also operates a 29 mile railroad from San Manuel and a 28 mile railroad from Superior. Both connect to the Santa Fe Southern Pacific system.

A wholly owned subsidiary, MCR Products, consisting of a rod plant rated at 140,000 tons per year, in Chicago, Ill. was sold to Cyprus in February, 1990.

San Manuel Division

**P.O. Box M, San Manuel, Arizona 85631
- Phone (602) 385-3100**

The San Manuel Division consists of a block-caving underground copper- molybdenum mine, a 62,000 ton per day concentrator, an open pit oxide copper mine, pad leach, in-situ leach, SX-EW plant, an 800,000 ton per year smelter with a 2000 ton per day acid plant and a 300,000 ton per year electrolytic refinery and a 180,000 ton per year rod plant.

After development of the grizzly and haulage levels, caving is initiated by undercutting the ore block. The caved ore is drawn through the grizzlies to the haulage level. Haulage to the production shafts is by 23 ton trolley locomotives pulling ten 15-17 ton ASEA cars or fifteen 12-13 ton rotary dump cars. After hoisting to the surface the ore is hauled by rail to the mill in 100 ton cars in groups of 35 to 40 pulled by 125 ton diesel-electric locomotives. Development of the Kalamazoo ore body was resumed and limited production is expected in late 1990.

The 62,000 ton per day concentrator was modernized by installing larger but fewer cyclones, by replacing controls with programmable controllers, by replacing small flotation cells with nine 2000 cubic foot Maxwell cells and seventy-two 300 cubic foot machines in the rougher circuit and by replacing conventional cells with column cells in the cleaner circuit.

At the smelter the reverberatory furnaces were replaced with an Outokumpu Flash Smelting Furnace. At a design capacity of 3000 tons of

concentrate per day, it is the largest single furnace smelter in the industry. An oxygen plant and modifications to the acid plant were a part of the modernization.

Mining at the open pit oxide mine is accomplished with hydraulic excavators and front end loaders with truck haulage at the rate of 19,000 tons of ore and 33,000 tons of waste per day. Ore is placed on the polyethylene lined leach pads and some of the waste is dumped in the subsidence area. Any sulfide ore that is encountered is hauled to a railroad siding and added to the feed going to the concentrator. Copper is recovered from the leach solutions at the SX-EW plant that uses the ISA process of plating the copper on stainless steel sheets rather than on copper starter sheets. The solutions from the in-situ leaching are also fed to this plant that was expanded to a capacity of 50,000 tons of copper per year.

Cathodes from the electrolytic refinery and the SX-EW plant are melted and cast into continuous rods at the rod plant.

Pinto Valley Division

**P.O. Box 100, Miami, Arizona 85631 -
Phone (602) 425-7611**

The Pinto Valley Division consists of the Pinto Valley Unit and the Miami Unit. At the Pinto Valley Unit mining is accomplished with electric shovels and truck haulage to the 63,000 ton per day concentrator. The addition of 14 1000 cubic foot rougher cells in the concentrator in 1989 is expected to increase the recovery rate by two percentage points. A dump leaching and a 6000 gpm SX-EW plant are also in operation. The concentrates and cathodes are shipped to San Manuel.

At Miami solutions from the in-situ leaching of the old Miami Copper block cave area are treated by SX-EW. Construction of the project to slurry and leach the Miami Copper Company tailings from #2 tailing dam was completed in 1989. This is a process to slurry the tailings by hydraulic mining, leach with sulfuric acid, thicken, extract the copper at the SX-EW plant, and pump the tailings to the mined out Cities Service pit at Sleeping Beauty. To accommodate the additional solution the solvent extraction plant at Miami was modified and the electrowinning tank house was expanded to a capacity of 6,000 gallons per minute of pregnant solution. The tailing thickeners at the old mill were rebuilt to separate the pregnant solution from the solids after leaching.

PHELPS DODGE CORPORATION

Corporate Headquarters - 2600 North Central Avenue, Phoenix, Arizona 85004-3015 - Phone (602) 234-8100

Phelps Dodge Mining Company was formed in September, 1988 as one of two operating divisions of Phelps Dodge Corporation. It is the nation's largest copper producer and accounts for about one-third of the nation's copper production at its mines in southeastern Arizona and southwestern New Mexico. In conjunction with its Arizona operations, Phelps Dodge operates the Hidalgo Smelter near Playas, New Mexico, a 420,000 ton per year refinery at El Paso Texas, a mine at Tyrone and the Chino Mine near Silver City, New Mexico in which it acquired a two-thirds interest from Kennecott at the end of 1986.

The Chino Mines Branch consists of an open pit copper mine, a 45,000 ton per day concentrator, a dump leach precipitation plant, a 500,000 ton per year INCO Flash smelter with

an acid plant, and a 45,000 ton per year solvent extraction-electrowinning plant. The mine and concentrator are located at Santa Rita about 15 miles east of Silver City. The smelter is located about 9 miles south of the mine at Hurley.

The Hidalgo smelter near Playas, New Mexico is an Outokumpu flash furnace rated at 500,000 tons per year. During 1986 the oxygen enrichment plant from the Morenci smelter was installed to increase capacity and efficiency. The resulting increase in sulfur dioxide concentration of the gases improved the operation of the acid plant as well.

The development of an underground mine at the Dos Pobres property near Safford, Arizona was suspended in 1982, allowed to flood in August 1984, and remains inactive. In 1986 Phelps Dodge acquired the nearby Lone Star property from Kennecott.

At Copper Basin near Prescott, Phelps Dodge has continued to pursue a land trade with the Forest Service. This property is being considered as a possible replacement for the Tyrone operation that is scheduled to cease mining operations in the early 1990's.

In addition to its Arizona-New Mexico copper properties Phelps Dodge operates a fluorspar mine in South Africa through its wholly owned subsidiary Phelps Dodge Mining (Pty) Limited and two copper-gold mines in Chile through its wholly owned subsidiary Compania Minerao Ojos del Salado SA. It also has interests in Black Mountain Mining Development Company (Pty) Limited, which operates a major lead-silver-zinc-copper mine in South Africa, and Southern Peru Copper Corporation in Peru.

Phelps Dodge Industries, the other operating division of Phelps Dodge Corporation, produces carbon black through its wholly

owned subsidiary Colombian Chemical Company, wheels and rims for heavy trucks through Accuride Corporation acquired in March, 1988, and Magnet Wire, etc. through Phelps Dodge Magnet Wire Company.

Morenci Branch

Morenci, Arizona 85540 - Phone (602) 865-4521

The Morenci Branch consists of the combined Morenci-Metcalf open pit copper mine, the 60,000 ton per day Morenci concentrator with a molybdenum circuit, the 40,000 ton per day Metcalf concentrator, and a dump leach - SX-EW operation. The 650,000 ton per year smelter with a 2400 ton per day acid plant remain inactive and will require extensive modifications to meet air quality restraints if ever reactivated. Sumitomo Mining Arizona, Inc. holds an undivided 15% interest in the Morenci branch excluding the inactive smelter.

Mining is conducted with electric shovels and truck haulage utilizing a computer controlled Modular Mining Truck Dispatching System for maximum efficiency. During 1989 the completion of the in pit crushing and conveying (IPCC) system eliminated rail haulage completely. The trucks are dumped into the two semi-mobile primary crushers in the pit and the crushed ore is conveyed to the coarse ore stockpile by conveyor belt. Each concentrator is fed by conveyors running under the stockpile. Both concentrators are standard flotation mills except that column flotation cells have been installed in the cleaner circuit of each. Total production of these two concentrators was 235,700 tons in 1989.

All mined material other than ore is classified as leach material and is taken to one of several leach dumps. There are three widely spaced

solvent extraction plants to upgrade the solutions before they are pumped to the centrally located tank house for electrowinning. During 1989, the capacity of the SX-EW system was doubled from 50,000 to 100,000 tons of cathode copper per year. As part of the Northwest Extension project the SX-EW capacity will be increased to 170,000 tons per year. This project will initially provide acid soluble material for leaching and will develop sulfide feed for the concentrates.

Copper Queen Branch

Highway 92, Bisbee, Arizona 85603 - Phone (602) 432-3621

The Copper Queen facility consists of a dump leaching and precipitation operation at the mined out Lavender pit.

A drilling program on an area north of the Lavender pit was conducted in 1987 to define a possible ore body amenable to treatment by heap leaching and SX-EW. The results of a feasibility study are not yet available.

New Cornelia Branch

Ajo, Arizona 85321 - Phone (602) 387-7451

The New Cornelia Branch consists of an open pit copper mine, a 30,000 ton per day concentrator with a molybdenum circuit and a 190,000 ton per year smelter with an acid plant. The mine has been inactive since August 1984 and the smelter was shut down in April 1985. There are no immediate plans to reactivate the operation but it is being considered as a replacement for the Tyrone operation if economic conditions are suitable in the early 1990's.

SEVERANCE TAX ON METALLIFEROUS MINERALS

Background

Laws of 1982, Chapter 230, repealed the tax on sales of metalliferous minerals and enacted a severance tax in its place. Under the provisions of the severance tax, metalliferous minerals were to be taxed at the time of production, not at the time of sale. All metalliferous minerals produced after 1982 were to be taxed on the greater of the following 2 values:

1. The "weighted mineral value" which is essentially the cost of extracting the minerals from the earth and delivering them to the site where they will be processed, or
2. A specified percentage of the old sales tax base.

The severance tax was to be levied on metalliferous minerals at a rate of 2 1/2 percent. Unless otherwise provided by law, the tax was to be administered in the same manner as the sales tax. As a result, severance tax payments were due on the first day of the second month following the month in which the tax accrued. From January 1, 1983 through June 30, 1983, 40 percent of the severance tax was to be distributed in the same manner as the transaction privilege tax (i.e. 25 percent to the cities, 33.6 percent to the counties and 41.4 percent to the state). In subsequent fiscal years, a progressively larger share of the severance tax was to be distributed in the same manner as the transaction privilege tax. The balance of severance tax collections, after making this distribution, was to be deposited each year in the state's general fund. (Effective from and after December 31, 1982.)

Laws of 1983, Chapter 4 changed the due date for payment of the Severance Tax to the twen-

tieth day of the month following the month in which the tax accrues. Taxes were to be delinquent if not received by the Department of Revenue on the day preceding the last day of the month in which they were due. (Effective April 1, 1983). The law also changed the interest rate on delinquent tax payments to equal the rate established by Section 6621 of the Internal Revenue Code, compounded annually. (Effective February 11, 1983.)

Legal Citation

A.R.S. 42-1461 - 42-1466.

Paid by

Persons engaged in the business of extracting substances from the earth that become metalliferous minerals (A.R.S. 42-1461 - 42-1462.)

Exemptions

None.

Tax Base

The severance tax is levied on the "net severance base" of all metalliferous minerals produced after 1982 (42-1462). The "net severance base" is the greater of the following 2 values (42-1464, Laws of 1982, Chapter 230, Section 12):

1. The "weighted mineral value", or
2. A specified percentage of the old sales tax base (the gross value of production less out-of-state processing costs). This value will be referred to as the "Arizona value" after June 30, 1985.

The "weighted mineral value" is essentially the cost of extracting the minerals from the

earth and delivering them to the site where they will be processed.

The "weighted mineral value" is determined using the following formula (42- 1464):

$$\text{weighted mineral value} = \frac{\text{mining costs}}{\text{total production costs}} \times \text{gross value of production}$$

where:

- mining costs represent the cost of extracting the minerals from the earth and delivering them to the site where they will be processed further (42-1461).
- total production costs include most of the major costs incurred in mining and processing minerals until the point of sale (42-1461).
- gross value of production is determined by multiplying the recoverable units of a metallic product by the per unit price of the product; the price per unit does not include the cost of manufacturing, fabricating or otherwise transforming a refined mineral product, when these activities occur prior to sale of the product (42-1461).

Although metalliferous minerals will no longer be taxed on the old sales tax base, the value of minerals produced after 1982 may not fall below a specified percentage of the old tax value (42-1464, Laws of 1982, Chapter 230, Section 12). The old tax value included not only the cost of extracting the minerals from the earth, but most of the major in-state costs of producing the minerals. This value was determined by multiplying the recoverable

units of a metallic product by the per unit price and deducting the out-of-state processing costs from the result (42-1464; Laws of 1982, Chapter 230, Section 12; 41-1461). The following table shows the minimum percentage of the old tax value that may be assigned to minerals for severance tax purposes (42-1464; Laws of 1982, Chapter 230, Section 12):

| Period during which minerals are produced | Minimum value of minerals for purposes of determining the severance tax |
|---|---|
| Jan. 1, 1983 - June 30, 1983 | 100% of the old taxable sale value |
| July 1, 1983 - June 30, 1984 | 83 1/3% of the old taxable sale value |
| July 1, 1984 - June 30, 1985 | 66 2/3% of the old taxable sale value |
| July 1, 1985 and thereafter | 50% of the old taxable sale value |

Tax Rate

During fiscal years 1980-81, 1981-82 and 1982-83, businesses that produced mineral products were permitted to claim a tax credit against the Special Excise Tax for Education. The tax credit was determined by formula (see "TAX CREDIT" under "SPECIAL EXCISE TAX FOR EDUCATION"). The tax credit could not exceed the taxpayer's Special Excise Tax liability for the year. However, if a taxpayer had an unused amount of credit for any year in which his production was curtailed due to economic conditions, the unused credit could be carried forward for a period not to exceed three years. Since the Special Excise Tax does not apply to metalliferous minerals after December 31, 1982, businesses that produce metalliferous minerals are authorized to claim this tax credit against their severance tax liability, beginning in 1983. In 1982-83, the amount of credit claimed may not exceed 40 percent of the taxpayer's severance tax liability

(Laws of 1982, Chapter 228, Section 2; Laws of 1982, Chapter 230, Section 15).

Due Date

Collections from the severance tax on metaliferous minerals are due on the twentieth day of the month following the month in which the tax accrues. Taxes are delinquent if they are not received by the Department of Revenue on the day preceding the last day of the month in which they are due. The due date may be extended by the Department of Revenue for good cause, but not beyond the first day of the third month following the regular due date (42- 1465, 42-1322).

Collecting Agency

Department of Revenue. (42-1462, 42-101)

Dedication or Purpose

To aid in defraying the necessary and ordinary expenses of the state, cities, and counties to reduce or eliminate the annual tax levy on property for state, city and county purposes and to reduce the levy on property for public school education (Laws of 1982, Chapter 230, Section 17).

Yield

No monies will be collected from this tax until fiscal year 1982-83.

Distribution

Each year, a portion of severance tax collections will be distributed in the same manner as the transaction privilege tax (i.e. 25 percent to the cities, 33.6 percent to the counties and 41.4 percent to the state). The portion of collections that is distributed in this manner will increase each fiscal year until 1986-87. The table below shows the amount of severance

tax collections that will be distributed in the same manner as transaction privilege taxes during each fiscal year (42-1465, Laws of 1982, Chapter 230, Section 16).

| Period during which collections are received | Portion of severance tax collections distributed in the same manner as the transaction privilege tax |
|--|--|
| January 1, 1983 - June 30, 1983 | 40% |
| July 1, 1983 - June 30, 1984 | 48% |
| July 1, 1984 - June 30, 1985 | 60% |
| July 1, 1985 and thereafter | 80% |

After making this distribution the balance of severance tax collections will be deposited each year in the state's general fund and is appropriated for public educational purposes (42-1465; Laws of 1982, Chapter 230, Section 16).

Source: State of Arizona Tax Handbook - 1983

Prepared by the Staff of the Joint Legislative Budget Committee

PROPERTY TAX

The following has been excerpted from "**Appraisal Manual for Mines and Natural Resources**" by Donald E. Ross of the Arizona Department of Revenue which was effective as of January 1, 1988 and is revised annually.

The Natural Resource Unit of the Division of Property Valuation and Equalization is assigned the responsibility of valuing producing and nonproducing mines and oil, gas, and geothermal interests. Arizona Department of Revenue mine valuation regulations R15-4-201 through R15-4-206 are incorporated into this manual.

Arizona Revised Statutes (ARS Section 42-201.8) states:

"Producing mine or mining claim" means any mine or mining claim from which any coal, mineral or mineral substance, other than clay, sand, gravel, building stone or any mineral substance normally processed into artificial stone, has been extracted for commercial purposes at any time during a period of one year prior to the first Monday in January of the tax year."

A producing mine includes the land utilized for mining purposes together with structures and facilities necessary to sustain mining operations. It also includes equipment used directly in the process of extracting ores or minerals from the earth for commercial purposes, including equipment required to prepare the materials for extraction and the handling, loading or transportation of such extracted material to the surface. Mining includes underground, surface and open-pit operations for the extraction of ores and minerals.

If mining operations cease, real and personal property associated with a mining operation will continue to be valued by Centrally Valued Properties for a period of three years. The nonoperating mine will be retained in the legal class 1 for the first year after mining operations are terminated. The legal class designation used for the next two years will depend on the use of the property, which could be class 4 if the property remains idle.

Three years after mining operations have ceased, the valuation of the nonproducing mining property will be transferred from the Centrally Valued Properties' jurisdiction to the Locally Valued Properties' jurisdiction. From this point on, the county assessor is responsible for classifying and valuing the subject property. Such property will be classified according to its current use. If the real and/or personal property is idle at the expiration of the three-year period, it normally will be classified legal Class Four property.

The Natural Resource Unit of the Centrally Valued Properties Section of the Arizona Department of Revenue is responsible for determining annually the value of all producing mines as of the first day of January of the tax year. Property within the context of a producing mine excludes manufacturing operations such as a rod plant. In summary, the value of taxable producing mine property for Arizona property tax purposes includes land, supplies inventories, ore reserves, construction work in progress, personal property and improvements.

Summary of Procedures

Producing mines are taxed on the basis of their assessed value multiplied by the local tax rate which produces the tax due. The

assessment ratio for 1988 is 28% of the full cash value or market value. The full cash value is determined by the mineral property appraiser after correlating the three approaches to value, namely the income, cost and market approaches.

The income approach consists of discounting two different future income streams as developed by (1) the mining company and (2) by the Department utilizing a single rate factor. The Department has developed a method in which a five-year history, expressed as a profit margin, is combined with the future production schedule to produce a future income stream. The historical data are expressed on a production basis, not on a sales basis. This five-year margin method avoids the problems of predicting the future price of copper and other metals. It is supported in the literature and has been approved by the Arizona Supreme Court. The past is only a valid indicator of the performance level of a relatively stable operation and should not be used for new or dying mines. The historical data are averaged to flatten the effects of the peaks and it is generally accepted as standard for financial reporting, and the Securities and Exchange Commission reports.

Cost approach values are determined by computing the reproduction cost new less depreciation for the physical assets. Straight line depreciations is utilized along with appreciation or inflation factors as developed by the Department (Table I). Economic and functional obsolescence can be allowed for by the appraiser if warranted.

Comprehensive field notes are written for each mine annually. Contacts with the mining industry are maintained in order to keep abreast of development in technology and discount rates. Technical papers and literature are collected, indexed, and placed in the listing of references for each mine appraisal

report. Detailed production statistics are maintained in order to analyze the historical performance for the mine.

TABLE I
COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES
1989

| COMPANY/MINE | TONS COPPER ORE MINED | TONS COPPER ORE MILLED | POUNDS RECOVERABLE COPPER | POUNDS RECOVERABLE MOLYBDENUM | TONS WASTE/OVERBURDEN REMOVED |
|---|-----------------------------|------------------------------|---------------------------------|-------------------------------------|-------------------------------------|
| <u>ARIMETCO</u> | | | | | |
| Emerald Isle In Situ/Cementation | | | 48,000 | | |
| Total | | | 48,000 | | |
| <hr style="border-top: 1px dashed black;"/> | | | | | |
| <u>ASARCO, INC.</u> | | | | | |
| Mission Unit | | | | | |
| Sulphide | 9,927,000 | 9,927,000 | 117,243,000 | | 14,016,000 |
| San Xavier ¹ | 3,072,000 | 3,072,000 | 26,765,000 | | 20,655,000 |
| Ray Unit | | | | | |
| Sulphide | 9,524,000 | 9,524,000 | 153,879,000 | | 25,412,000 |
| Oxide | 5,311,000 | | | | |
| Heap Leach/SX-EW | | | 58,071,000 | | |
| Dump Leach/SX-EW | | | 21,862,000 | | |
| Silver Bell Unit | | | | | |
| Dump Leach/Cementation | | | 10,017,000 | | |
| Total | 27,834,000 | 22,523,000 | 387,837,000 | | 60,083,000 |

¹ San Xavier ore concentrated at Mission Complex.

(continued)

TABLE 1 (CONT'D)

COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES 1989

| COMPANY/MINE | TONS COPPER ORE MINED | TONS COPPER ORE MILLED | POUNDS RECOVERABLE COPPER | POUNDS RECOVERABLE MOLYBDENUM | TONS WASTE/OVERBURDEN REMOVED |
|-----------------------------------|-----------------------------|------------------------------|---------------------------------|-------------------------------------|-------------------------------------|
| <u>CYPRUS MINERALS CO.</u> | | | | | |
| Bagdad | | | | | |
| Sulphide | 22,844,000 | 22,381,000 | 176,372,000 | 8,697,000 | 28,095,000 |
| Dump Leach/SX-EW | | | 22,262,000 | | |
| Casa Grande | | | | | |
| In Situ/SX-EW | | | 5,000,000 | | |
| Miami | | | | | |
| Oxide | 20,115,000 | | | | 19,241,000 |
| Heap Leach/SX-EW ¹ | | | 124,179,000 | | |
| Dump Leach/Cementation | | | 188,000 | | |
| Mineral Park | | | | | |
| In Situ/Cementation | | | 1,526,000 | | |
| Dump Leach/Cementation | | | 1,812,000 | | |
| Sierrita | | | | | |
| Sulphide | 32,190,000 | 32,190,000 | 151,800,000 | 14,900,000 | 25,409,000 |
| Dump Leach/SX-EW ² | | | 8,400,000 | | |
| Twin Buttes | | | | | |
| Sulphide | 2,814,000 | 2,814,000 | 67,322,000 | | 23,563,000 |
| Oxide | | | 18,800,000 | | |
| Agitation Leach/SX-EW | 1,216,000 | | | | |
| Total | 79,179,000 | 57,385,000 | 577,661,000 | 23,597,000 | 96,308,000 |

¹. Although some of this production is from old dumps, it is undifferentiated and is reported as heap leach.

² Sulphide ore is concentrated at Sierrita Concentrator.

(continued)

TABLE 1 (CONT'D)

**COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES
1989**

| COMPANY/MINE | TONS COPPER ORE MINED | TONS COPPER ORE MILLED | POUNDS RECOVERABLE COPPER | POUNDS RECOVERABLE MOLYBDENUM | TONS WASTE/OVERBURDEN REMOVED |
|--|-----------------------------|------------------------------|---------------------------------|-------------------------------------|-------------------------------------|
| <u>KOCIDE MINING CORP.</u> | | | | | |
| Van Dyke ¹ In Situ/Cementation | | | 654,000 | | |
| Total | | | 654,000 | | |
| <i>1. Operation permanently suspended in October 1989.</i> | | | | | |
| ----- | | | | | |
| <u>MAGMA COPPER CO.</u> | | | | | |
| Pinto Valley Division | | | | | |
| Sulphide | 21,229,000 | 21,610,000 | 162,550,000 | 1,268,000 | 32,480,000 |
| Dump Leach/SX-EW | | | 10,214,000 | | |
| Miami | | | 8,882,000 | | |
| In Situ | | | 1,917,000 | | |
| No. 2 Tailings | 1,349,000 | | | | |
| San Manuel Division | | | | | |
| Underground-Sulphide | 16,582,000 | 16,672,000 | 180,793,000 | 3,039,000 | |
| Open Pit-Sulphide | 71,000 | 71,000 | 976,000 | | 23,201,000 |
| -Oxide | 9,417,000 | | | | |
| Heap Leach/SX-EW | | | 60,143,000 | | |
| In Situ/SX-EW | | | 8,712,000 | | |
| Total | 48,648,000 | 38,353,000 | 434,187,000 | 4,307,000 | 55,681,000 |

(continued)

TABLE 1 (CONT'D)

**COPPER AND MOLYBDENUM PRODUCTION OF LARGE ARIZONA COPPER MINES
1989**

| COMPANY/MINE | TONS COPPER ORE MINED | TONS COPPER ORE MILLED | POUNDS RECOVERABLE COPPER | POUNDS RECOVERABLE MOLYBDENUM | TONS WASTE/OVERBURDEN REMOVED |
|---|-----------------------------|------------------------------|---------------------------------|-------------------------------------|-------------------------------------|
| <u>PHELPS DODGE CORP.</u> | | | | | |
| Copper Queen Branch Dump Leach/Cementation | | | 4,762,000 | | |
| Morenci Branch ¹ Sulphide | 41,023,000 | 40,659,000 | 471,412,000 | 1,891,000 | 49,869,000 |
| Dump Leach/SX-EW | | | 126,892,000 | | |
| Dump Leach/Cementation | | | 6,329,000 | | |
| Total | 41,023,000 | 40,659,000 | 609,395,000 | 1,891,000 | 49,869,000 |
| <i>1. Includes Sumitomo's 15%.</i> | | | | | |
| ----- | | | | | |
| Totals | | | | | |
| Sulphide | 159,276,000 | 158,920,000 | 1,509,112,000 | 29,795,000 | 219,499,000 |
| Oxide (Leach) | 37,408,000 | | | | 43,442,000 |
| Heap Leach/SX-EW | | | 242,393,000 | | |
| Dump Leach/SX-EW | | | 189,630,000 | | |
| Dump Leach/Cementation | | | 23,108,000 | | |
| In Situ/SX-EW | | | 22,594,000 | | |
| In Situ/Cementation | | | 2,228,000 | | |
| Agitation Leach/SX-EW | | | 20,717,000 | | |
| Sub Total Leached | | | 500,670,000 | | |
| SX-EW Cementation | | | 475,334,000 25,336,000 | | |
| GRAND TOTAL | 196,684,000 | 158,920,000 | 2,009,782,000 | 29,795,000 | 261,941,000 |

TABLE II
ARIZONA LEACH COPPER PRODUCTION (1)

(Thousand Pounds)

| <u>MINE OPERATION</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> |
|---------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| ARIMETCO | | | | | | | | | | |
| Emerald Isle | -- | -- | -- | -- | -- | -- | -- | -- | -- | 48 |
| Johnson (2) | 10,302 | 10,693 | 9,702 | -- | 8,803 | 6,200 | -- | -- | -- | -- |
| ASARCO INCORPORATED | | | | | | | | | | |
| Silver Bell | 4,423 | 7,950 | 8,687 | 10,374 | 9,152 | 8,800 | 6,814 | 12,800 | 8,660 | 10,017 |
| Ray (3) | 25,875 | 25,788 | 22,420 | 20,033 | 20,457 | 23,706 | 56,639 | 68,543 | 76,966 | 79,933 |
| CYPRUS MINES CORP. | | | | | | | | | | |
| Bagdad | 12,668 | 13,244 | 13,173 | 13,282 | 14 | 14,259 | 13,958 | 16,470 | 19,100 | 22,262 |
| Bluebird (4) | 13,017 | 13,328 | NR | -- | -- | -- | -- | -- | -- | -- |
| Casa Grande (5) | -- | 26,071 | 45,611 | 3,244 | 15,401 | 13,514 | 7,100 | 4,145 | 4,300 | 5,000 |
| Miami (6) | 28,958 | 50,532 | 50,000 | 78,988 | 79,549 | 85,136 | 98,747 | 105,555 | 115,293 | 124,367 |
| Mineral Park (7) | 3,690 | 4,194 | 3,191 | 3,101 | 2,718 | 3,798 | 4,251 | 4,405 | 4,500 | 3,338 |
| Ox Hide (6) | 1,015 | 761 | 1,572 | -- | -- | -- | -- | -- | -- | -- |
| Sierrita/Esperanza (7) | 9,991 | 11,566 | 9,354 | 6,367 | 8,500 | 10,000 | 8,770 | 7,943 | 8,556 | 8,400 |
| Twin Buttes (8) | 63,719 | 67,922 | 60,796 | 50,649 | 50,239 | 19,824 | -- | -- | -- | 18,800 |
| KOCIDE MINING CORP. | | | | | | | | | | |
| Van Dyke | -- | -- | -- | -- | -- | -- | -- | -- | 67 | 654 |
| MAGMA COPPER CO. | | | | | | | | | | |
| Copper Cities | 3,984 | 3,622 | 2,046 | -- | -- | -- | -- | -- | -- | -- |
| Pinto Valley/Miami | 11,184 | 15,736 | 26,958 | 24,632 | 25,602 | 23,947 | 22,252 | 22,724 | 23,413 | 21,013 |
| San Manuel (9) | -- | -- | -- | -- | -- | -- | 21,923 | 51,278 | 62,956 | 68,855 |
| PHELPS DODGE CORPORATION | | | | | | | | | | |
| Copper Queen Branch | 6,052 | 4,600 | 4,545 | 5,200 | 3,493 | 4,144 | 3,454 | 2,730 | 2,700 | 4,762 |
| Morenci Branch | 86,840 | 96,090 | 75,735 | 69,158 | 60,312 | 53,228 | 56,261 | 45,249 | 108,426 | 133,221 |
| New Cornelia Branch | -- | -- | 661 | -- | 920 | 402 | -- | -- | -- | -- |

continued

TABLE II (CONT'D)

ARIZONA LEACH COPPER PRODUCTION

(Thousand Pounds)

| <u>MINE OPERATION</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| RANCHERS | | | | | | | | | | |
| Old Reliable | 1,128 | 149 | -- | -- | -- | -- | -- | -- | -- | -- |
| TOTALS | 282,846 | 352,246 | 334,451 | 285,028 | 285,160 | 266,958 | 300,169 | 341,842 | 434,937 | 500,670 |
| PERCENT OF PRIMARY COPPER PRODUCED (10) | 16.4 | 15.0 | 19.6 | 18.8 | 18.0 | 15.0 | 17.1 | 19.8 | 23.1 | 24.9 |

(1) Copper recovered by precipitation or by solvent extraction from material dump, heap, vat or in situ leached.

(2) Arimetco acquired Johnson Camp from Cyprus in August 1989.

(3) Asarco purchased Ray Unit from Kennecott, November 18, 1986.

(4) Operated by Ranchers, became part of Inspiration Area Mines, July, 1984 and Cyprus Miami, July, 1988.

(5) Hecla Lakeshore through 3/31/79; Noranda Lakeshore through 6/31/87; Now Cyprus Casa Grande.

(6) Sold by Inspiration to Cyprus, July 1, 1988.

(7) Cyprus purchased Sierrita/Esperanza and Mineral Park from Duval, April 1, 1986.

(8) Operated by ANAMAX. Acquired by Cyprus, March, 1988.

(9) Open Pit, Heap Leach, SX-EW start-up in spring of 1986. Some In Situ test production.

(10) Leach Copper compared to total copper produced as reported in this report, Table I.

Source: Arizona Department of Mines and Mineral Resources; This report, Table I-II

TABLE III
RANK OF ARIZONA'S COPPER COMPANIES
BY PRODUCTION OF COPPER AND MOLYBDENUM
1989

| <u>Copper</u> | | | <u>Molybdenum</u> | | |
|---------------|------------------------------------|-------------------------------|-------------------|-----------------------------------|-------------------------------|
| <u>Rank</u> | <u>Company</u> | <u>% of AZ Production</u> | <u>Rank</u> | <u>Company</u> | <u>% of AZ Production</u> |
| 1 | Phelps Dodge Corp. 609,395,000 | 30.3 | 1 | Cyprus Minerals Co. 23,597,000 | 79.2 |
| 2 | Cyprus Minerals Co. 577,661,000 | 28.8 | 2 | Magma Copper Co. 4,307,000 | 14.5 |
| 3 | Magma Copper Co. 434,187,000 | 21.6 | 3 | Phelps Dodge Corp. 1,891,000 | 6.3 |
| 4 | Asarco Inc. 387,837,000 | 19.3 | | | |
| 5 | Kocide Mining Corp. 654,000 | 0.0 | | | |
| 6 | Arimetco 48,000 | 0.0 | | | |
| TOTAL | 2,009,782,000 | 100.0 | | 29,795,000 | 100.0 |

TABLE IV

**RANK OF ARIZONA'S COPPER MINES
BY PRODUCTION OF COPPER AND MOLYBDENUM
1989**

| <u>Rank</u> | <u>Copper</u> | | <u>Rank</u> | <u>Molybdenum</u> | |
|--------------|--|-------------------------------------|-------------|--|-------------------------------------|
| | <u>Mine/Company</u> <u>Copper Produced, lb.</u> | <u>% of AZ</u> <u>Production</u> | | <u>Mine/Company</u> <u>Moly Produced, lb.</u> | <u>% of AZ</u> <u>Production</u> |
| 1 | Morenci/Phelps Dodge 604,633,000 | 30.1 | 1 | Sierrita, Twin Buttes/ Cyprus 14,900,000 | 50.0 |
| 2 | San Manuel/Magma 250,624,000 | 12.5 | 2 | Bagdad/Cyprus 8,697,000 | 29.2 |
| 3 | Sierrita, Twin Buttes/ Cyprus 246,322,000 | 12.3 | 3 | San Manuel/Magma 3,039,000 | 10.2 |
| 4 | Ray/Asarco 233,812,000 | 11.6 | 4 | Morenci/Phelps Dodge 1,891,000 | 6.3 |
| 5 | Bagdad/Cyprus 198,634,000 | 9.9 | 5 | Pinto Valley/Magma 1,268,000 | 4.3 |
| 6 | Pinto Valley, Miami/Magma 183,563,000 | 9.1 | | | |
| 7 | Mission/Asarco 144,008,000 | 7.2 | | | |
| 8 | Miami/Cyprus 124,367,000 | 6.2 | | | |
| 9 | Silver Bell/Asarco 10,017,000 | 0.5 | | | |
| 10 | Casa Grande/Cyprus 5,000,000 | 0.2 | | | |
| 11 | Copper Queen/Phelps Dodge 4,762,000 | 0.2 | | | |
| 12 | Mineral Park/Cyprus 3,338,000 | 0.2 | | | |
| 13 | Van Dyke/Kocide 654,000 | 0.0 | | | |
| 14 | Emerald Isle/Arimetco 48,000 | 0.0 | | | |
| Total | 2,009,782,000 | 100.00 | | 29,795,000 | 100.00 |

TABLE V
**ARIZONA MINE PRODUCTION
 OF RECOVERABLE COPPER IN SHORT TONS**

| | <u>1985</u> | | <u>1986</u> | | <u>1987</u> | | <u>1988</u> | | <u>1989</u> | |
|--------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | <u>AMOUNT</u> | <u>CHANGE</u> |
| <u>BY MONTH</u> | | | | | | | | | | |
| JANUARY | 72,508 | 6.5% | 78,138 | 7.8% | 71,816 | (8.1)% | 77,612 | 8.1% | 81,455 | 5.0% |
| FEBRUARY | 67,823 | 8.6 | 67,524 | (0.4) | 65,448 | (3.1) | 73,465 | 12.2 | 79,227 | 7.8 |
| MARCH | 76,717 | 16.1 | 72,834 | (5.1) | 72,674 | (0.2) | 82,552 | 13.6 | 91,491 | 10.8 |
| APRIL | 75,928 | 24.3 | 70,306 | (7.4) | 67,637 | (3.8) | 76,379 | 12.9 | 79,549 | 4.2 |
| MAY | 76,690 | 16.0 | 73,446 | (4.2) | 69,843 | (4.9) | 77,872 | 11.5 | 82,315 | 5.7 |
| JUNE | 70,816 | (0.4) | 72,747 | 2.7 | 68,985 | (5.2) | 75,089 | 8.8 | 78,643 | 4.7 |
| JULY | 72,534 | 3.3 | 74,009 | 2.0 | 68,090 | (8.0) | 77,316 | 13.5 | 80,152 | 3.7 |
| AUGUST | 74,134 | 5.9 | 71,488 | (3.6) | 69,596 | (2.6) | 82,747 | 18.9 | 84,995 | 2.7 |
| SEPTEMBER | 70,732 | 1.7 | 72,402 | 2.4 | 69,498 | (4.0) | 77,467 | 11.5 | 80,169 | 3.5 |
| OCTOBER | 74,081 | 1.0 | 76,159 | 2.8 | 71,478 | (6.1) | 79,386 | 11.1 | 82,790 | 4.3 |
| NOVEMBER | 73,129 | (0.6) | 70,220 | (3.6) | 75,349 | 7.3 | 76,173 | 1.1 | 77,303 | 1.5 |
| DECEMBER | 78,987 | 14.6 | 70,635 | (10.6) | 76,930 | 8.9 | 80,906 | 5.2 | 81,502 | 0.7 |
| <u>CUMULATIVE YEAR TO DATE</u> | | | | | | | | | | |
| JANUARY | 72,508 | 6.5% | 78,138 | 7.8% | 71,816 | (8.1)% | 77,612 | 8.1% | 81,455 | 5.0% |
| FEBRUARY | 140,331 | 7.5 | 145,662 | 3.8 | 137,264 | (5.8) | 151,077 | 10.1 | 160,682 | 6.4 |
| MARCH | 217,048 | 10.4 | 218,496 | 0.7 | 209,938 | (3.9) | 233,629 | 11.3 | 252,173 | 7.9 |
| APRIL | 292,976 | 13.7 | 288,802 | (1.4) | 277,575 | (3.9) | 310,008 | 11.7 | 331,722 | 7.0 |
| MAY | 369,666 | 14.2 | 362,248 | (2.0) | 347,418 | (4.1) | 387,880 | 11.6 | 414,037 | 6.7 |
| JUNE | 440,482 | 11.5 | 434,995 | (1.2) | 416,403 | (4.3) | 462,969 | 11.2 | 492,680 | 6.4 |
| JULY | 513,016 | 10.3 | 509,004 | (0.8) | 484,493 | (4.8) | 540,285 | 11.5 | 572,832 | 6.0 |
| AUGUST | 587,150 | 9.7 | 580,492 | (1.1) | 554,089 | (4.5) | 623,032 | 13.3 | 657,827 | 5.6 |
| SEPTEMBER | 657,882 | 8.8 | 652,894 | (0.8) | 623,587 | (4.5) | 700,499 | 12.3 | 737,996 | 5.4 |
| OCTOBER | 731,963 | 8.0 | 729,053 | (0.4) | 695,065 | (4.7) | 779,885 | 12.2 | 820,786 | 5.2 |
| NOVEMBER | 805,092 | 7.1 | 799,273 | (0.7) | 770,414 | (3.6) | 856,058 | 11.1 | 898,089 | 4.9 |
| DECEMBER | 884,079 | 7.7 | 869,908 | (1.6) | 847,344 | (2.6) | 936,964 | 11.2 | 979,591 | 4.5 |
| AVERAGE MONTH | 73,673 | 7.7% | 72,492 | (1.6)% | 70,612 | (2.6)% | 78,080 | 10.6% | 81,633 | 4.5% |

NOTE: Percentage change column shows change from corresponding period in prior year. Parentheses indicate a negative change.

Source: U.S. Department of the Interior, Bureau of Mines

Prepared By: State of Arizona Joint Legislative Budget Committee

TABLE VI
AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

| <u>MINE OPERATION</u> | | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> |
|---------------------------------|---------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| ASARCO INCORPORATED | | | | | | | | | | | |
| Mission (1) | Sulphide | 0.75 | 0.75 | (0.75) | (0.75) | (0.75) | 0.65 | 0.70 | 0.67 | 0.73 | 0.70 |
| Pima (1) | Sulphide | 0.49 | 0.49 | 0.48 | -- | -- | -- | -- | -- | -- | -- |
| Ray Unit 2 (3) | Sulphide | 0.91 | 0.97 | 0.80 | 1.19 | 1.13 | 0.99 | 0.99 | 0.89 | 1.00 | 0.97 |
| | Oxide (Silicate) | -- | -- | -- | -- | -- | 1.17 | 1.23 | 1.15 | 1.11 | 1.13 |
| San Xavier (1) | Sulphide | 0.65 | 0.65 | (0.65) | (0.51) | (0.51) | -- | -- | -- | -- | 0.55 |
| CYPRUS MINES CORPORATION | | | | | | | | | | | |
| Bagdad | Sulphide | 0.50 | 0.50 | 0.50 | 0.50 | 0.45 | 0.44 | 0.45 | 0.48 | 0.45 | 0.49 |
| Bluebird (4) | Oxide | 0.40 | 0.40 | -- | -- | -- | -- | -- | -- | -- | -- |
| Christmas (OP) (5) | Sulphide | 0.73 | 0.62 | -- | -- | -- | -- | -- | -- | -- | -- |
| Esperanza (6) | Sulphide | 0.32 | 0.29 | 0.29 | -- | -- | -- | -- | -- | -- | -- |
| Johnson | Oxide | 0.40 | 0.40 | 0.40 | 0.40 | 0.71 | -- | -- | -- | -- | -- |
| Lakeshore | Oxide | -- | 1.00 | 1.00 | (1.00) | (1.00) | -- | -- | -- | -- | -- |
| Miami (5) | Sulphide | 0.58 | 0.58 | 0.58 | 0.53 | 0.55 | 0.60 | 0.54 | -- | -- | -- |
| | Oxide | -- | -- | -- | -- | 0.50 | 0.49 | 0.57 | 0.59 | 0.52 | 0.49 |
| Mineral Park (6) | Sulphide | 0.24 | 0.32 | -- | -- | -- | -- | -- | -- | -- | -- |
| Sierrita (6) | Sulphide | 0.34 | 0.30 | 0.30 | (0.30) | 0.34 | 0.33 | 0.34 | 0.33 | 0.30 | 0.31 |
| Twin Buttes (7) | Sulphide | 0.82 | 0.74 | 0.78 | 0.57 | -- | -- | -- | -- | 3.39 | 1.90 |
| | Oxide | 1.26 | 1.20 | 1.06 | 0.93 | 0.86 | 0.84 | -- | -- | 1.22 | 1.13 |
| MAGMA COPPER COMPANY | | | | | | | | | | | |
| Pinto Valley | Sulphide | 0.49 | 0.46 | 0.46 | -- | 0.44 | 0.45 | 0.45 | 0.36 | 0.37 | 0.46 |
| San Manuel | Sulphide | 0.65 | 0.64 | 0.66 | 0.64 | 0.64 | 0.61 | 0.62 | 0.62 | 0.63 | 0.64 |
| | Oxide | -- | -- | -- | -- | -- | -- | 0.58 | 0.64 | 0.61 | 0.56 |
| Superior | Sulphide | 4.32 | 4.48 | 4.32 | -- | -- | -- | -- | -- | -- | -- |

(continued)

TABLE VI (CONT'D)

AVERAGE COPPER CONTENT OF ORE PRODUCED AT ARIZONA COPPER MINES

(Percent Total Copper)

| <u>MINE OPERATION</u> | | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> |
|---------------------------------|----------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| PHELPS DODGE CORPORATION | | | | | | | | | | | |
| Metcalf | Sulphide | 0.69 | -- | 0.78 | -- | -- | -- | -- | -- | -- | -- |
| Morenci (8 | Sulphide | 0.82 | 0.74 | 0.72 | 0.73 | 0.81 | 0.86 | 0.84 | 0.82 | 0.88 | 0.79 |
| New Cornelia | Sulphide | 0.51 | 0.50 | 0.64 | 0.60 | 0.55 | -- | -- | -- | -- | -- |
| WEIGHTED AVERAGE | | | | | | | | | | | |
| SULPHIDE GRADE | | 0.58 | 0.58 | 0.59 | 0.65 | 0.70 | 0.62 | 0.61 | 0.58 | 0.60 | 0.62 |

() Percentage in parenthesis is approximate: Not used in calculation of weighted average.

(1 Combined as Mission Complex in 1985.

(2 Ray Unit acquired from Kennecott, November 18, 1986.

(3 Grade reported for Ray Unit is an average of oxide and sulphide together though 1982.

(4 Bluebird property acquired by Inspiration in 1984 and by Cyprus as part of Cyprus Miami, March 1988.

(5 Acquired from Inspiration, July 1, 1988.

(6 Sierrita, Esperanza and Mineral Park acquired from Duval Corp., April 1, 1986.

(7 Included ANAMAX share of Palo Verde deposit for 1979-1982. Acquired by Cyprus, March 1988.

(8 Combined Metcalf and Morenci mines production in 1983 et seq.

(9 Weighted average grade of ore milled, based generally on an assay of total copper.

Source: Company annual reports, Form 10-K's and Prospectus: Personal correspondence and Arizona Department of Mines and Mineral Resources.

TABLE VII
PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES

(Percent of Total Copper)

| <u>MINE OPERATION</u> | | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> |
|---------------------------------|----------|-------------|-------------|-----------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| ASARCO INCORPORATED | | | | | | | | | | | |
| Mission (1 | Sulphide | 87 | 94 | 85 | 80 (80 est) | | 92 | 91 | 89 | 87 | 84 |
| Pima (1 | Sulphide | 84 | 76 | 89 | -- | -- | -- | -- | -- | -- | -- |
| Ray (2 | Sulphide | -- | 70 | 70 (70 est) | | 83 | 81 | 82 | 84 | 83 | 81 |
| San Xavier (1 | Sulphide | 66 | 76 | 78 | 79 (80 est) | | -- | -- | -- | -- | 79 |
| CYPRUS MINES CORPORATION | | | | | | | | | | | |
| Bagdad | Sulphide | 76 | 94 | 83 | 83 | 92 | 91 | 93 | 90 | 91 | 84 |
| | Oxide | -- | -- | -- | -- | 52 | 51 | 54 | 42 | 46 | 90 |
| Bluebird (3 (4 | Oxide | 41 | 156 | -- | -- | -- | -- | -- | -- | -- | -- |
| Christmas (OP) (6 | Sulphide | 70 | 71 | -- | -- | -- | -- | -- | -- | -- | -- |
| Esperanza (5 | Sulphide | 90 | 87 | -- | -- | -- | -- | -- | -- | -- | -- |
| Johnson | Oxide | 86 | 86 | -- | 62 (62 est) | | -- | -- | -- | -- | -- |
| Miami (7 | Sulphide | 81 | 74 | 68 | 86 | 80 | 76 | 66 | 69 | N/A | 93 |
| Mineral Park (5 | Sulphide | 84 | 75 | -- | -- | -- | -- | -- | -- | -- | -- |
| Sierrita (5 | Sulphide | 86 | 80 | 98 (?) (88 est) | | 89 | 92 | 91 | 89 | 87 | 86 |
| Twin Buttes (8 | Sulphide | 87 | 85 | -- | -- | -- | -- | -- | -- | 87 | 83 |
| | Oxide | 76 | 77 | 87 (80 est) | | 80 (80 est) | | -- | -- | -- | 72 |
| MAGMA COPPER COMPANY | | | | | | | | | | | |
| Pinto Valley | Sulphide | 83 | 94 | 95 | -- | 88 | 80 | 84 | 82 | 84 | 82 |
| San Manuel | Sulphide | 95 | 87 | 89 | 86 | 90 | 90 | 90 | 85 | 86 | 82 |
| Superior | Sulphide | 95 | 93 (93 est) | | -- | -- | -- | -- | -- | -- | -- |
| PHELPS DODGE CORP. | | | | | | | | | | | |
| Metcalf | Sulphide | 58 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Morenci (9 | Sulphide | 64 | 69 | 68 | 71 | 70 | 86 | 76 | 74 | 72 | 73 |
| New Cornelia | Sulphide | 79 | 78 | 85 | 78 | 76 | -- | -- | -- | -- | -- |

continued

TABLE VII (CONT'D)

PERCENT CONTAINED COPPER RECOVERED AT ARIZONA COPPER MINES

(Percent of Total Copper)

- (1) *Combined as Mission Complex in 1985.*
- (2) *Ray Unit acquired from Kennecott, November 18, 1986.*
- (3) *Bluebird property acquired by Inspiration in 1984 and by Cyprus as part of Cyprus Miami, July 1, 1988.*
- (4) *Recovery by leaching heaps continued after mining was terminated in July 1981.*
- (5) *Sierrita, Esperanza, and Mineral Park acquired from Duval Corp., April 1, 1987.*
- (6) *Acquired from Inspiration, July 1, 1988.*
- (7) *Percent recovery by leaching since 1986. Acquired from Inspiration, July 1, 1988.*
- (8) *Recovery includes ANAMAX's share of Palo Verde 1981-1982-1983-1984. Acquired by Cyprus in March, 1989.*
- (9) *Includes Metcalf production since 1981.*

TABLE VIII
STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES (1)

(Waste:Ore)

| <u>MINE OPERATION</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1986</u> | <u>1987</u> | <u>1988</u> | <u>1989</u> |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| ASARCO INCORPORATED | | | | | | | | | | |
| Eisenhower (2 (3 | -- | 0.71:1 | 0.67:1 | 0.57:1 | 1.26:1 | -- | -- | -- | -- | -- |
| Mission (3 | 3.05:1 | 2.01:1 | 1.62:1 | 2.52:1 | 1.32:1 | 0.74:1 | 0.84:1 | 1.05:1 | 2.02:1 | 1.41:1 |
| Pima (3 | 6.28:1 | 3.06:1 | 1.42:1 | -- | -- | -- | -- | -- | -- | -- |
| Ray (4 | 3.15:1 | 1.88:1 | 2.30:1 | 2.72:1 | 2.11:1 | 2.27:1 | 2.12:1 | 1.99:1 | 2.10:1 | 1.70:1 |
| Sacaton | 2.02:1 | 1.30:1 | 0.70:1 | 0.35:1 | 0.10:1 | -- | -- | -- | -- | -- |
| San Xavier (3 | 6.01:1 | 6.18:1 | 2.90:1 | 0.96:1 | 1.97:1 | -- | -- | -- | -- | 6.72:1 |
| Silver Bell | -- | 1.41:1 | -- | 1.09:1 | 1.17:1 | -- | -- | -- | -- | -- |
| CYPRUS MINES CORPORATION | | | | | | | | | | |
| Bagdad | 1.52:1 | 1.78:1 | 1.45:1 | 1.53:1 | 0.94:1 | 0.42:1 | 0.54:1 | 0.77:1 | 1.96:1 | 1.23:1 |
| Bluebird (5 (6 | 1.50:1 | 0.003:1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Christmas (7 | 4.40:1 | 3.24:1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Esperanza (8 | 0.76:1 | 1.95:1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Johnson | 2.01:1 | 1.52:1 | -- | 0.03:1 | -- | -- | -- | -- | -- | -- |
| Miami (7 | 2.40:1 | 1.53:1 | 1.42:1 | 0.27:1 | 1.72:1 | 1.50:1 | 1.82:1 | 2.04:1 | 2.01:1 | 0.96:1 |
| Mineral Park (8 | 1.71:1 | 1.44:1 | -- | -- | -- | -- | -- | -- | -- | -- |
| Sierrita (8 | 1.11:1 | 0.98:1 | 0.55:1 | 0.33:1 | 0.76:1 | 0.55:1 | 0.19:1 | 0.40:1 | 0.67:1 | 0.77:1 |
| Twin Buttes (9 | 3.32:1 | 3.62:1 | 2.05:1 | 1.14:1 | -- | -- | -- | -- | 34.60:1 | 8.37:1 |
| MAGMA | | | | | | | | | | |
| San Manuel Oxide | -- | -- | -- | -- | -- | -- | 1.70:1 | 2.46:1 | 2.32:1 | 2.45:1 |
| Pinto Valley | 1.07:1 | 1.77:1 | 1.80:1 | -- | 0.79:1 | 1.01:1 | 1.21:1 | 1.32:1 | 1.39:1 | 1.53:1 |
| PHELPS DODGE CORPORATION | | | | | | | | | | |
| Metcalf | 1.67:1 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Morenci (10 | 1.30:1 | 1.63:1 | 0.79:1 | 0.64:1 | 0.90:1 | 0.68:1 | 0.76:1 | 1.10:1 | 1.13:1 | 1.22:1 |
| New Cornelia | 2.27:1 | 0.48:1 | 1.21:1 | 0.30:1 | 0.58:1 | -- | -- | -- | -- | -- |
| WEIGHTED AVERAGE* | 1.90:1 | 1.57:1 | 1.31:1 | 0.57:1 | 1.10:1 | 0.88:1 | 0.96:1 | 1.21:1 | 1.49:1 | 1.46:1 |

(continued)

TABLE VIII (CONT'D)

STRIPPING RATIOS AT ARIZONA OPEN-PIT COPPER MINES (1)

(Waste:Ore)

- (1 Leachable rock included with waste (except at solely leach operations).
- (2 Mining was done by ASARCO, includes ANAMAX's share of ore.
- (3 Combined as Mission Complex in 1985.
- (4 Ray Unit acquired from Kennecott, November 18, 1986.
- (5 Stripping of overburden ceased in January 1981, but mining continued until July.
- (6 Bluebird Property acquired by Inspiration in 1984 and by Cyprus as part of Cyprus Miami, July 1, 1988.
- (7 Acquired from Inspiration, July 1, 1988.
- (8 Sierrita, Esperanza and Mineral Park acquired from Duval, April 1, 1986.
- (9 Acquired by Cyprus, March, 1988.
- (10 Combined Morenci and Metcalf 1981 et. seq.

Source: "Minerals Yearbook - Area Reports: Domestic", U.S. Bureau of Mines; Company Annual Reports; *E&MJ International Directory of Mining and Mineral Processing Operations*; Arizona Department of Mines & Mineral Resources; Company submitted data beginning in 1985.

*NOTE: These are now weighted averages so use caution in making comparisons to the averages presented in previous editions of this report prior to 1981.

TABLE IX

**ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER
RECOVERED FROM COPPER ORE**

| <u>Year</u> | <u>Copper Ore Tons</u> | <u>Gold Troy Ounces Value (3)</u> | <u>Silver Troy Ounces Value (4)</u> | <u>Molybdenum (1 1,000 lbs. Value (in \$1,000)</u> | <u>Copper (2 Pounds Value</u> | <u>Copper (2 Lbs. Cu/ton ore Ave.¢/lb. (5)</u> | <u>Value of Copper Gold, Silver & Molybdenum</u> |
|-------------|----------------------------|---|---|--|---------------------------------------|--|--|
| 1972 | 165,914,825 | 102,526 5,987,518 | 6,614,957 11,143,226 | 27,126 46,791 | 1,695,858,000 858,392,446 | 10.22 50.617 | 922,314,190 |
| 1973 | 181,311,945 | 102,376 10,013,397 | 7,164,988 18,325,173 | 37,657 59,372 | 1,735,012,000 1,021,314,814 | 9.57 58.865 | 1,109,025,384 |
| 1974 | 178,913,296 | 90,206 14,488,424 | 6,308,721 29,701,332 | 28,346 57,067 | 1,609,808,000 1,233,901,735 | 9.00 76.649 | 1,335,158,491 |
| 1975 | 168,750,152 | 82,759 13,364,751 | 6,190,805 27,354,196 | 25,030 61,411 | 1,502,978,000 954,917,072 | 8.91 63.535 | 1,057,047,019 |
| 1976 | 194,136,559 | 97,961 12,276,473 | 7,308,395 31,816,805 | 31,073 89,148 | 1,912,430,000 1,316,210,823 | 9.85 68.824 | 1,449,452,101 |
| 1977 | 168,641,401 | 87,874 13,032,593 | 6,696,415 30,957,660 | 34,574 120,497 | 1,705,240,000 1,122,184,339 | 10.11 65.808 | 1,166,295,089 |
| 1978 | 178,204,491 | 92,508 17,905,108 | 6,611,781 35,709,502 | 33,029 150,142 | 1,817,670,000 1,190,755,617 | 10.20 65.510 | 1,244,520,369 |
| 1979 | 203,977,408 | 99,549 30,622,766 | 7,454,306 82,699,941 | 35,101 213,065 | 1,914,501,095 1,767,735,441 | 9.39 92.334 | 2,094,081,895 |
| 1980 | 169,650,401 | 71,533 43,814,606 | 5,640,703 116,376,559 | 36,299 324,150 | 1,521,850,812 1,543,400,219 | 8.97 101.416 | 2,027,741,384 |
| 1981 | 216,787,430 | 95,496 43,891,299 | 7,565,368 79,575,340 | 35,600 273,052 | 2,143,898,000 1,795,385,941 | 9.89 83.744 | 2,191,904,580 |

(continued)

TABLE IX (CONT'D)

**ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER
RECOVERED FROM COPPER ORE**

| <u>Year</u> | <u>Copper Ore Tons</u> | <u>Gold Troy Ounces Value (3)</u> | <u>Silver Troy Ounces Value (4)</u> | <u>Molybdenum (1) 1,000 lbs. Value (in \$1,000)</u> | <u>Copper (2) Pounds Value</u> | <u>Copper (2) Lbs. Cu/ton ore Ave. ¢/lb. (5)</u> | <u>Value of Copper Gold, Silver & Molybdenum</u> |
|-------------|----------------------------|---|---|---|--|--|--|
| 1982 | 146,124,870 | 61,050 22,949,000 | 6,301,000 50,090,000 | 22,099 100,673 | 1,697,500,000 1,261,415,000 | 11.62 74.31 | 1,435,127,000 |
| 1983 | 152,902,150 | 61,991 26,284,000 | 4,492,000 51,383,000 | 23,934 79,459 | 1,495,208,000 1,144,285,000 | 9.78 76.53 | 1,301,411,000 |
| 1984 | 145,278,431 | 51,548 18,591,200 | 4,093,000 33,320,000 | 23,184 78,827 | 1,582,549,000 1,044,483,000 | 10.89 66.00 | 1,175,151,000 |
| 1985 | 159,547,970 | 52,053 16,585,000 | 4,885,000 30,007,000 | 30,428 98,827 | 1,778,334,456 1,166,571,000 | 11.14 65.60 | 1,311,990,000 |
| 1986 | 153,439,000 | 63,334 23,370,000 | 4,202,000 22,987,000 | 29,382 75,607 | 1,752,525,000 1,157,543,000 | 11.42 66.05 | 1,279,507,000 |
| 1987 | 166,113,000 | 48,430 21,694,000 | 3,530,000 24,745,000 | 15,939 51,802 | 1,724,068,000 1,370,924,000 | 10.38 79.52 | 1,469,165,000 |
| 1988 | 175,261,000 | 67,000 ^(e) 29,579,000 | 4,742,000 31,000,000 | 29,132 78,074 | 1,885,112,000 2,243,283,000 | 10.76 119.00 | 2,381,637,000 |
| 1989 | 196,684,000 | 69,000 ^(e) 26,524,000 | 4,926,600 27,236,000 | 29,795 99,545 | 2,009,782,000 2,592,723,000 | 10.22 129.01 | 2,746,028,000 |

(continued)

TABLE IX (CONT'D)

ARIZONA PRODUCTION AND VALUE OF COPPER, MOLYBDENUM, GOLD AND SILVER
RECOVERED FROM COPPER ORE

- (1) *Molybdenum content of recovered concentrate.*
- (2) *Excludes precipitate copper from dump and in-place leaching prior to 1982.*
- (3) *At average annual domestic, free market gold price.*
- (4) *At E&MJ average annual N.Y. market price for .999 fine silver.*
- (5) *At E&MJ average annual price, U.S. Producer Cathode Preliminary.*
- (e) *Estimated*
- (p) *Preliminary.*

Source: Table I, this publication - U.S. Bureau of Mines State Mineral Summaries.

TABLE X
NONFUEL MINERAL PRODUCTION IN ARIZONA⁽¹⁾

| MINERAL | 1988 | | 1989 ^(p) | |
|--|----------------------|-----------------------|---------------------|------------------|
| | Quantity | Value | Quantity | Value |
| Clays -----short tons -- | 185,620 | \$1,590 | 211,580 | \$2,010 |
| Copper ⁽²⁾ -----metric tons -- | 845,445 | 2,246,093 | 890,940 | 2,592,793 |
| Diatomite -----short tons -- | 8,000 | 1,208 | 8,100 | 1,208 |
| Gem Stones ----- | NA | 3,300 | NA | 3,300 |
| Gold ⁽²⁾ -----kilograms -- | 4,549 | 64,106 | 2,849 | 35,264 |
| Lime -----do. -- | 674 | 29,637 | W | W |
| Perlite -----thousand short tons -- | W | W | W | W |
| Pumice -----thousand short tons -- | 1 | 7 | -- | -- |
| Sand and Gravel: | | | | |
| Constructon ----- | 32,399 | 123,854 | 33,800 | 133,500 |
| Industrial ----- | 119 | 3,045 | W | W |
| Silver ⁽²⁾ -----metric tons----- | 152 | 31,974 | 153 | 27,236 |
| Stone: | | | | |
| Crushed -----thousand short tons -- | 7,400 ^(e) | 33,000 ^(e) | 5,300 | 26,200 |
| Dimension -----short tons -- | W | 1 ^(e) | W | 1 |
| Combined value of cement, lead (1988), molybdenum, pyrites, salt, tin (1988-89), and values indicated by symbol W ----- | XX | 235,596 | XX | 368,824 |
| Total ----- | xx | 2,773,411 | XX | 3,190,266 |

(e) Estimated.

(p) Preliminary.

NA Not available.

W Withheld to avoid disclosing company proprietary data; value included in "Combined value" figure.

XX Not applicable.

(1) Production as measured by mine shipments, sales, or marketable production (including consumption by producers.

Source: "The Mineral Industry of Arizona in 1989" Mineral Industry Surveys, U.S. Bureau of Mines.

TABLE XI
ESTIMATED
COPPER MINE CAPACITY IN ARIZONA (1)

(Short tons of Recoverable Copper/Year)

| <u>OPERATOR</u> | <u>MINE</u> | <u>CAPACITY</u> (2) |
|-----------------|---------------------|---------------------|
| Phelps Dodge | Morenci/Metcalf | 300,000 (a) |
| Magma | San Manuel | 130,000 (a) |
| Cyprus | Sierrita/Esperanza | 120,000 (b) |
| Asarco | Ray | 115,000 (c) |
| Cyprus | Bagdad | 100,000 (a) |
| ASARCO | Mission Complex | 87,000 (c) |
| Magma | Pinto Valley | 85,000 (a) |
| Cyprus | Inspiration Area | 62,000 (c) |
| Magma | Superior | 42,000 (d) |
| Phelps Dodge | New Cornelia | 40,000 (d) |
| Cyprus | Mineral Park | 17,000 (d) |
| Magma | Miami & Miami Tails | 14,000 (a)(b) |
| Cyprus | Christmas | 8,000 (d) |
| ASARCO | Silverbell | 4,000 (e) |
| Kocide | Van Dyke | 3,000 (b) |
| Cyprus | Casa Grande | 2,000 (e) |
| Phelps Dodge | Copper Queen | 2,000 (e) |
| TOTAL | | 1,131,000 |

(1) *Figures generally represent a current estimate of the productive capacity of primary recoverable copper in concentrates, precipitates, and cathodes. Figures do not represent smelter or refinery capacity. The estimates are based on recent production figures and on capacities of concentrator and leach plant facilities. Other factors affecting actual production include, for example, grade of ore and recovery. Some capacities have been published by the reporting company. Capacities for shut down operations are historic and not necessarily immediately available.*

(2) *Basis of capacity estimate*
 (a) *Recent production figures*
 (b) *Design capacity & ore grade*
 (c) *Company annual report or 10K*
 (d) *Historic data*
 (e) *Leaching only*

Source: Arizona Department of Mines & Mineral Resources file data; Company Annual Reports and Form 10-K; Professional Publications.

TABLE XII
COPPER SMELTERS
North America
End of 1989-Short Tons

| Company | Location Of Plant | Annual Capacity |
|--|---------------------|------------------|
| UNITED STATES | | |
| ASARCO Incorporated | | |
| El Paso Smelter | El Paso, TX | 450,000 |
| Hayden Smelter | Hayden, AZ | 720,000 |
| Hayden-Ray Smelter | Hayden, AZ | 360,000 |
| Chemetco Inc. | Alton, IL | 150,000 |
| Copper Range Company | White Pine, MI | 70,000 |
| Cyprus Miami Mining Corporation | Claypool, AZ | 408,000 |
| Kennecott Corporation | | |
| Kennecott Utah Copper | Garfield, UT | 820,000 |
| Magma Copper Company | | |
| San Manuel Division | San Manuel, AZ | 1,059,000 |
| Phelps Dodge Corporation | | |
| Chino Mines | Hurley, NM | 550,000 |
| Tyrone Branch | Playas, NM | 750,000 |
| Total (a) | | 5,337,000 |
| CANADA | | |
| Falconbridge Ltd. | Falconbridge, Ont. | 700,000 |
| Hudson Bay Mining and Smelting Co., Ltd. | Flin Flon, Manitoba | 340,000 |
| Inco Ltd. | Copper Cliff, Ont. | 1,800,000 |
| Noranda Mines Inc. | | |
| Gaspé Smelter | Murdochville, Que. | 240,000 |
| Horne Smelter | Rouyn-Noranda, Que. | 900,000 |
| Total (a) | | 3,980,000 |
| MEXICO | | |
| Compania Minera De Cananea, S.A. | Cananea, Son. | 277,000 |
| Industrial Minera Mexico, S.A. | San Luis Potosi | 42,000 |
| Mexicana De Cobre, S.A. De C.V. | Nacozari, Sonora | 672,000 |
| Total (a) | | 991,000 |

Source: American Bureau of Metal Statistics Inc.

The capacity of copper smelting works is given as estimated by the respective proprietors.
(a) Tons of material.

TABLE XIII

COPPER PRODUCTION BY COMPANIES (g)

Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---------|---------|---------|---------|---------|
| UNITED STATES | | | | | |
| Anamax Mining Company | 9,864 | -- | -- | -- | -- |
| ASARCO Incorporated | 85,470 | 98,200 | 194,800 | 206,000 | 235,700 |
| Cominco American Incorporated And Dresser Minerals (e) | 1,192 | 1,892 | 1,925 | 1,671 | 1,489 |
| Copper Range Company (f) | -- | 31,298 | 53,053 | 45,802 | 52,061 |
| Cyprus Bagdad Copper Corp. | 83,671 | 86,920 | 91,340 | 100,298 | 99,318 |
| Cyprus Casa Grande Corp. (m) | -- | -- | 879 | 2,150 | 2,512 |
| Cyprus Johnson Copper Company | 3,100 | 2,436 | -- | -- | -- |
| Cyprus Miami Mining Corp. (o) | (d) | (d) | (d) | 30,658 | 62,184 |
| Cyprus Mineral Park Corp. | -- | -- | 2,203 | 2,214 | 1,728 |
| Cyprus Pinos Altos Corp. | -- | -- | 130 | 4,189 | 1,398 |
| Cyprus Sierrita Corporation | 110,690 | 56,089 | 78,985 | 87,579 | 80,934 |
| Cyprus Tonapah | -- | -- | -- | 144 | 1,004 |
| Cyprus Twin Buttes | -- | -- | -- | 6,010 | 44,373 |
| The Doe Run Company | -- | -- | 13,018 | 22,936 | 20,220 |
| Hecla Mining Company (a) | 749 | 346 | 289 | 481 | 460 |
| Coeur Mine (j) | 61 | 62 | 58 | 47 | 50 |
| Galena Mine (k) | 154 | 141 | 121 | 125 | 129 |
| Lucky Friday Mine | 534 | 143 | 110 | 309 | 281 |
| Inspiration Consolidated Copper Company (f) | 40,402 | 32,085 | 35,582 | (d) | (d) |
| Kennecott Corporation (l) | 235,000 | 190,000 | 60,000 | 245,000 | 244,000 |
| Magma Copper Company (n) | 199,481 | 210,057 | 197,013 | 200,753 | 214,388 |
| Pinto Valley Division | 90,839 | 97,544 | 75,550 | 78,550 | 91,781 |
| San Manuel Division | 108,642 | 112,513 | 121,463 | 122,203 | 122,607 |
| Montana Resources | -- | 8,876 | 30,856 | 53,155 | 39,634 |
| Noranda Lakeshore Mines, Inc. (b) | 6,779 | 3,581 | -- | -- | -- |
| Phelps Dodge Corporation (U.S. mines) (b) | 410,076 | 405,400 | 468,900 | 451,800 | 515,495 |
| Tennessee Chemical Company | 8,450 | 7,475 | 4,560 | -- | -- |
| Refiners (c) | | | | | |
| AMAX Copper, Inc. | 28,508 | -- | -- | -- | -- |
| ASARCO Incorporated | 414,197 | 441,600 | 447,700 | 484,700 | 492,800 |

Source: American Bureau of Metal Statistics Inc.

(a) Includes Hecla's share of production from each mining property.

(b) Includes copper produced from purchased ores.

(c) The totals for these concerns are to a large extent duplications of the reports of other producers.

(d) Starting in 1988, Cyprus Miami Mining Corp.

(e) Magmont mine.

(f) Refined production.

(g) Copper content of mine production unless otherwise noted.

(j) Operated by ASARCO - Shows Hecla Mines share of 5%.

(k) Operated by ASARCO - Shows Hecla Mines share of 25%.

(l) Reported production of refined copper plus unrefined copper sales. Includes only Kennecott's share from jointly owned properties.

(m) Formerly Noranda Lakeshore.

(n) Refined copper contained in concentrates produced and SX-EW production.

(o) Formerly Inspiration Consolidated Copper Company.

TABLE XIV

Copper Imports Of The United States By Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|--------------------------------------|---------|---------|---------|---------|---------|
| Ores, Concentrates | | | | | |
| Mattes & Cement | 7,710 | 5,977 | 12,765 | 9,101 | 52,264 |
| Canada | 2,820 | 2,147 | 4,093 | 178 | -- |
| Mexico | 19 | -- | 6,753 | 6,822 | 47,581 |
| Honduras | 83 | -- | -- | -- | -- |
| Argentina | -- | 18 | -- | -- | -- |
| Bolivia | -- | -- | 7 | -- | -- |
| Chile | 77 | 71 | -- | 34 | 3,931 |
| Peru | 1,265 | 1,431 | 1,474 | 55 | -- |
| Venezuela | 664 | -- | -- | -- | -- |
| Ireland, Rep.of | -- | -- | -- | 1 | -- |
| Monaco | -- | -- | -- | -- | 76 |
| Sweden | -- | -- | -- | -- | 661 |
| United Kingdom | -- | -- | -- | -- | 3 |
| Japan | 524 | 639 | -- | -- | -- |
| Mozambique | -- | -- | -- | -- | 12 |
| Australia | 2,150 | 1,671 | 438 | 2 | -- |
| Papua New Guinea | -- | -- | -- | 2,009 | -- |
| Other Countries | 108 | -- | -- | -- | -- |
| Blister & Anodes | 28,635 | 51,049 | 47,991 | 108,505 | 85,117 |
| Canada | 2,559 | 3,248 | 15 | -- | 207 |
| Mexico | 2,117 | 20,068 | 15,457 | 1,145 | 7,325 |
| Chile | 19,823 | 27,409 | 21,532 | 53,206 | 37,161 |
| Peru | 3,819 | -- | 2,921 | 3,282 | 3,254 |
| Germany, F.R. | 72 | 269 | 95 | -- | -- |
| Switzerland | -- | -- | -- | 2 | -- |
| Japan | -- | -- | 2,189 | 32,150 | 24,580 |
| Cape Verde | -- | -- | -- | -- | 821 |
| Ivory Coast | -- | -- | -- | 5,647 | -- |
| South Africa | -- | -- | 5,782 | 9,815 | -- |
| Tanzania | -- | -- | -- | -- | 1,088 |
| Zaire | -- | -- | -- | 3,258 | 10,681 |
| Zambia | -- | 55 | -- | -- | -- |
| Other Countries | 245 | -- | -- | -- | -- |
| Refined Cathodes & Shapes | 415,675 | 541,990 | 556,973 | 367,150 | 333,016 |
| Canada | 141,085 | 219,969 | 231,078 | 195,996 | 199,312 |
| Mexico | 1,780 | 1,419 | 611 | 46 | 181 |
| Brazil | -- | -- | -- | 1,319 | 20,085 |
| Chile | 167,548 | 164,436 | 159,915 | 91,211 | 85,358 |
| Peru | 38,714 | 59,035 | 46,716 | 14,848 | 10,186 |
| Venezuela | -- | -- | -- | 137 | -- |
| Austria | -- | -- | -- | 495 | 21 |
| Belgium | 5,865 | 2,386 | 702 | 1,396 | -- |
| Finland | -- | -- | -- | 441 | -- |
| Germany, F.R. | 1,209 | -- | 34,680 | 5,573 | 310 |
| Netherlands | -- | -- | 7,043 | 5,567 | 2,680 |
| Norway | 886 | -- | 205 | 390 | 61 |
| Spain | -- | -- | -- | 3,530 | -- |
| Sweden | -- | -- | 16,788 | 4,157 | -- |
| Switzerland | -- | -- | -- | 385 | -- |
| United Kingdom | 3,541 | 6,381 | -- | -- | 21 |

continued

TABLE XIV (CONT'D)

Copper Imports Of The United States By Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|--|--------|--------|--------|--------|--------|
| Refined Cathodes & Shapes Cont. | | | | | |
| Yugoslavia | -- | -- | 4,629 | 2,199 | -- |
| Hong Kong | -- | -- | -- | 711 | -- |
| Japan | 5,241 | -- | 661 | -- | 3 |
| South Korea | 2,393 | -- | -- | -- | -- |
| Taiwan | -- | -- | 300 | -- | -- |
| Congo (Brazzaville) | -- | 3,155 | -- | -- | -- |
| Niger | -- | -- | -- | -- | 912 |
| South Africa | 6,453 | 11,101 | 5,046 | 1,985 | 1,193 |
| Zaire | 30,057 | 39,688 | 26,446 | 35,143 | 12,607 |
| Zambia | 9,821 | 32,714 | 21,834 | -- | -- |
| Australia | 8 | -- | -- | -- | -- |
| Poland | -- | -- | -- | 714 | -- |
| China | -- | -- | 165 | 845 | 71 |
| Other Countries | 1,074 | 1,706 | 154 | 62 | 15 |
| Copper Waste & Scrap | | | | | |
| Canada | 25,368 | 30,001 | 36,510 | 40,952 | 34,808 |
| Mexico | 20,148 | 22,529 | 28,302 | 28,860 | 21,350 |
| Bahamas | 3,471 | 5,692 | 5,890 | 8,036 | 3,933 |
| Barbados | -- | 249 | 23 | 37 | 17 |
| Costa Rica | -- | 86 | 67 | 72 | 56 |
| Dominican Republic | 125 | 127 | 214 | 224 | 594 |
| El Salvador | 94 | 265 | 592 | 648 | 515 |
| Guatemala | -- | -- | 167 | -- | -- |
| Haiti | 43 | 20 | 94 | 205 | 267 |
| Honduras | -- | -- | -- | -- | 49 |
| Jamaica | 49 | 37 | 41 | 53 | 38 |
| Netherlands Antilles | 160 | 128 | 62 | 194 | 207 |
| Panama | -- | -- | 94 | 139 | 31 |
| Trinidad | 428 | 378 | 431 | 977 | 703 |
| Chile | 97 | 18 | 93 | 209 | 336 |
| Peru | -- | -- | -- | 79 | 5,296 |
| Surinam | -- | -- | 55 | -- | -- |
| Venezuela | -- | -- | -- | 48 | -- |
| France | 164 | 1 | -- | 628 | 648 |
| Germany, F.R. | 50 | 40 | 24 | 119 | -- |
| Italy | 51 | 63 | -- | 111 | 325 |
| Netherlands | -- | -- | 62 | -- | -- |
| Switzerland | -- | -- | -- | -- | 304 |
| United Kingdom | 14 | -- | -- | -- | -- |
| South Korea | 69 | -- | 24 | 42 | 1 |
| Malaysia | 287 | 112 | 124 | 48 | 7 |
| Singapore | -- | -- | 30 | -- | -- |
| Taiwan | -- | -- | 79 | -- | -- |
| Other Countries | 1 | -- | 25 | 27 | -- |
| | 117 | 256 | 17 | 196 | 131 |

(continued)

TABLE XIV (CONT'D)

Copper Imports Of The United States By Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|----------------------|--------|--------|--------|--------|--------|
| Copper Alloy | | | | | |
| Waste & Scrap (a) | 35,201 | 43,008 | 48,703 | 55,146 | 87,435 |
| Canada | 22,660 | 28,303 | 32,661 | 31,120 | 42,720 |
| Mexico | 9,781 | 11,917 | 11,570 | 14,180 | 22,825 |
| Bahamas | -- | 46 | 37 | -- | 67 |
| Barbados | -- | -- | 41 | -- | 35 |
| Costa Rica | 84 | 14 | 40 | -- | 146 |
| Dominican Republic | 461 | 328 | 464 | 962 | 1,177 |
| Guatemala | 50 | 17 | 82 | 137 | 346 |
| Haiti | -- | -- | -- | 142 | 118 |
| Honduras | 29 | 20 | 2 | 107 | 68 |
| Jamaica | 140 | 140 | 136 | 204 | 353 |
| Netherlands Antilles | -- | -- | 257 | 249 | 340 |
| Panama | 517 | 731 | 784 | 739 | 935 |
| St. Vincent | -- | -- | -- | -- | 58 |
| Trinidad | 44 | 41 | 155 | 306 | 332 |
| Chile | 99 | 78 | 116 | 1,992 | 3,690 |
| Peru | -- | -- | 629 | 144 | -- |
| Venezuela | -- | -- | 208 | 1,040 | 6,772 |
| Belgium | -- | 14 | 43 | 1,675 | 1,577 |
| France | 59 | 21 | 24 | -- | 206 |
| Germany F.R. | 133 | 147 | 303 | 251 | 234 |
| Italy | -- | -- | 163 | -- | 21 |
| Netherlands | -- | -- | 41 | -- | -- |
| Portugal | -- | -- | -- | -- | 33 |
| Sweden | -- | 78 | 78 | -- | 21 |
| Switzerland | 34 | -- | 51 | -- | 47 |
| United Kingdom | 306 | 106 | 321 | 290 | 302 |
| Hong Kong | -- | -- | -- | 145 | 102 |
| Japan | 42 | -- | 57 | 210 | 336 |
| South Korea | 8 | 325 | 153 | -- | 95 |
| Malaysia | -- | 112 | 54 | -- | 47 |
| Philippines | 138 | 69 | -- | -- | 15 |
| Singapore | -- | -- | 114 | -- | 195 |
| Taiwan | 165 | -- | 36 | 358 | 3,835 |
| China | -- | -- | -- | 82 | 150 |
| Other Countries | 194 | 501 | 83 | 813 | 237 |

continued

TABLE XIV (CONT'D)

Copper Imports Of The United States By Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|------------------|--------|--------|--------|--------|-------|
| Master Alloys | 1,017 | 682 | 814 | 889 | 743 |
| Unwrought Alloys | 13,301 | 17,815 | 15,812 | 11,547 | 4,487 |

COPPER AND COPPER ALLOY IMPORTS OF BRASS MILL PRODUCTS (b)

| | | | | | |
|----------------------------------|---------|---------|---------|---------|--------|
| Strip, Sheet & Plate | | | | | |
| Copper | 46,860 | 43,985 | 33,997 | 37,167 | 37,859 |
| Copper Alloy | 157,729 | 142,311 | 114,376 | 99,981 | 81,235 |
| Foil | | | | | |
| Copper | 35,182 | 32,653 | 46,708 | 44,945 | 33,957 |
| Copper Alloy | 32,880 | 29,615 | 29,912 | 22,677 | 27,216 |
| Wire | | | | | |
| Copper Alloy | 13,009 | 22,585 | 23,833 | 25,028 | 22,143 |
| Rod, Bar & Other | | | | | |
| Copper | 36,875 | 38,970 | 31,391 | 31,474 | 29,617 |
| Copper Alloy | 50,983 | 55,756 | 64,579 | 74,634 | 75,622 |
| Tube & Pipe | | | | | |
| Copper | 64,832 | 84,963 | 100,021 | 91,924 | 72,896 |
| Copper Alloy | 62,251 | 61,857 | 57,224 | 59,493 | 66,882 |
| Copper Wire Insulated (c) | 83,016 | 95,201 | 103,597 | 106,022 | -- |
| Canada | 36,393 | 33,491 | 34,523 | 36,111 | -- |
| Mexico | 6,683 | 10,528 | 23,276 | 24,667 | -- |
| Costa Rica | -- | 2,757 | 2,350 | 2,516 | -- |
| Brazil | 5,904 | 4,141 | 3,157 | 5,371 | -- |
| Chile | 918 | 1,444 | 829 | 607 | -- |
| Peru | 5,251 | 4,499 | 3,587 | 5,443 | -- |
| Venezuela | -- | 3,427 | 3,276 | 3,425 | -- |
| France | 2,598 | 2,538 | 4,130 | 2,688 | -- |
| Germany, F.R. | 921 | -- | 1,171 | 1,172 | -- |
| Italy | 3,111 | 3,011 | 1,763 | 807 | -- |
| Spain | 3,227 | 4,205 | 3,728 | 297 | -- |
| Sweden | 85 | -- | -- | -- | -- |
| United Kingdom | 718 | -- | -- | -- | -- |
| Yugoslavia | 2,595 | 2,898 | 3,072 | 4,777 | -- |
| Hong Kong | -- | -- | 113 | 639 | -- |
| Israel | 810 | -- | 616 | 663 | -- |
| Japan | 3,149 | 6,862 | 4,329 | 2,547 | -- |
| South Korea | 3,274 | 5,797 | 4,914 | 6,746 | -- |
| Taiwan | -- | 5,563 | 7,342 | 5,998 | -- |
| Other Countries | 7,379 | 4,040 | 1,421 | 1,548 | -- |

Source: American Bureau of Metal Statistics, Inc., U.S. Bureau of the Census Current monthly data available, report 010, for the above table on an annual subscription basis.

(a) Copper alloy content. (b) Thousands of pounds. (c) Gross weight.
n.a.-Not available at time of publication.

TABLE XV

Copper Exports of the United States by Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|--|----------------|----------------|----------------|----------------|----------------|
| Ores, Concentrates, Mattes & Cement | 128,206 | 192,183 | 137,512 | 239,438 | 350,843 |
| Canada | 3,050 | 6,993 | 2,013 | 9,367 | 15,212 |
| Mexico | -- | -- | 4 | 2,151 | 921 |
| Brazil | -- | -- | -- | -- | 44,651 |
| Belgium | 100 | -- | -- | -- | 4,051 |
| Finland | -- | 5,096 | 7,968 | 1,967 | 7,982 |
| France | -- | -- | -- | -- | 110 |
| Germany, F.R. | -- | -- | 976 | 37,051 | 15,419 |
| United Kingdom | -- | -- | -- | -- | 555 |
| Yugoslavia | -- | -- | 4113 | -- | 6,211 |
| India | -- | -- | -- | -- | 35 |
| Indonesia | -- | -- | -- | -- | 136 |
| Israel | -- | -- | -- | -- | 4 |
| Japan | 113,352 | 145,103 | 109,737 | 149,762 | 190,668 |
| South Korea | 7,628 | 15,548 | 5,681 | 13,225 | 37,734 |
| Malaysia | -- | -- | -- | -- | 170 |
| Philippines | -- | -- | -- | 3,511 | 7,990 |
| Taiwan | 4,076 | 5,505 | 4,162 | 3,291 | 9,605 |
| Australia | -- | -- | -- | -- | 251 |
| Bularia | -- | -- | -- | -- | 5,026 |
| Germany, D.R. | -- | -- | -- | 8,757 | -- |
| China | -- | 13,771 | 2,723 | 10,316 | 4,028 |
| Other Countries | -- | 167 | 135 | 40 | 84 |
| Blister & Anodes | 19,817 | 17,598 | 13,600 | 36,023 | 6,035 |
| Canada | 408 | 437 | 922 | 10,818 | 3,473 |
| Mexico | 2,804 | -- | 303 | 584 | 117 |
| Chile | -- | -- | -- | -- | 472 |
| Germany, F.R. | 100 | -- | -- | 5241 | 42 |
| Spain | -- | 100 | 5 | 1164 | -- |
| United Kingdom | -- | -- | -- | -- | 43 |
| Hong Kong | 6 | 185 | 784 | 740 | 627 |
| Japan | -- | 776 | 4,706 | -- | 175 |
| South Korea | 16,177 | 14,879 | 5,122 | 16,279 | 30 |
| Saudi Arabia | -- | -- | -- | -- | 114 |
| Singapore | 76 | 94 | 112 | 217 | 122 |
| Taiwan | 93 | 636 | 521 | 588 | 606 |
| Other Countries | 153 | 491 | 1,125 | 212 | 214 |
| Refined Cathodes & Shapes | 53,037 | 16,446 | 20,304 | 64,574 | 147,391 |
| Canada | 6,165 | 5,357 | 4,943 | 4,238 | 5,215 |
| Mexico | 12,729 | 317 | 4,674 | 9,409 | 8,097 |
| Costa Rica | -- | -- | -- | -- | 436 |
| Dominican Republic | -- | -- | 46 | -- | 93 |
| El Salvador | -- | -- | -- | -- | 108 |
| Honduras | -- | -- | -- | -- | 291 |
| Brazil | 53 | 126 | 501 | 56 | 19 |
| Chile | -- | -- | -- | -- | 70 |
| Venezuela | 27 | 149 | 134 | -- | 1,429 |
| Belgium | 671 | -- | 391 | 234 | 21 |

continued

TABLE XV (CONT'D)

Copper Exports of the United States by Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|---------------------------------|----------------|----------------|----------------|----------------|----------------|
| France | 318 | 516 | 535 | 1,690 | 760 |
| Germany, F.R. | 1,439 | 1,533 | 514 | 1,456 | 1,430 |
| Italy | -- | -- | 218 | 4,984 | 652 |
| Netherlands | 19,343 | 305 | 276 | 9,583 | 731 |
| Switzerland | 40 | 108 | 49 | 137 | 249 |
| United Kingdom | 806 | 2,469 | 1,185 | 2,729 | 1,197 |
| Hong Kong | 1,050 | 661 | 458 | 592 | 644 |
| Israel | 30 | -- | -- | -- | 77 |
| Japan | 5,605 | -- | 3,036 | 14,877 | 53,544 |
| South Korea | 1,146 | 1,473 | 2,063 | 6,755 | 1,645 |
| Malaysia | -- | -- | -- | 512 | -- |
| Philippines | -- | -- | -- | 106 | 2 |
| Singapore | -- | -- | 2 | 1,410 | 1,328 |
| Taiwan | 1,609 | 2,835 | 1,178 | 1,776 | 55,109 |
| Australia | 4 | -- | -- | -- | 13 |
| China | 25 | -- | -- | 3,905 | 14,191 |
| Other Countries | 1,977 | 597 | 101 | 155 | 40 |
| Copper Waste & Scrap | 148,040 | 150,375 | 119,776 | 132,025 | 170,789 |
| Canada | 18,277 | 15,149 | 12,273 | 32,159 | 41,956 |
| Mexico | 13,507 | 6,488 | 13,533 | 12,672 | 8,639 |
| Brazil | 1,875 | 4,374 | 3,326 | 655 | 892 |
| Venezuela | -- | -- | 217 | 337 | 20 |
| Belgium | 10,383 | 3,552 | 2,154 | 3,100 | 3,991 |
| Finland | -- | -- | 97 | -- | -- |
| France | 182 | -- | -- | -- | 59 |
| Germany, F.R. | 18,654 | 9,385 | 4,774 | 10,748 | 14,570 |
| Italy | 7,553 | 13,585 | 6,769 | 920 | 280 |
| Netherlands | 4,395 | 1,887 | 406 | 1,019 | 3,779 |
| Norway | -- | -- | -- | 118 | 245 |
| Portugal | -- | -- | -- | -- | 50 |
| Spain | 5,292 | 6,191 | 8,877 | 3,725 | 958 |
| Sweden | 234 | -- | -- | -- | -- |
| Switzerland | -- | -- | -- | 17 | 122 |
| United Kingdom | 4,303 | 1,637 | 822 | 2,547 | 1,354 |
| Hong Kong | 1,590 | 6,312 | 3,656 | 1,579 | 1,242 |
| India | 1,102 | 792 | 545 | 2,222 | 1,203 |
| Indonesia | -- | -- | -- | -- | 456 |
| Japan | 14,829 | 13,835 | 17,141 | 17,780 | 22,411 |
| South Korea | 15,284 | 13,632 | 10,650 | 21,540 | 35,936 |
| Philippines | -- | -- | 1,045 | -- | 133 |
| Singapore | 1,062 | 754 | 1,262 | 2,313 | 134 |
| Taiwan | 27,650 | 51,694 | 31,791 | 17,959 | 25,503 |
| Thailand | 8 | -- | -- | -- | 1 |
| Australia | 58 | -- | 157 | -- | -- |
| China | -- | -- | 210 | 470 | 6,666 |
| Other Countries | 2,864 | 1,108 | 71 | 145 | 49 |

continued

TABLE XV (CONT'D)

Copper Exports of the United States by Countries

Copper Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|----------------|----------------|----------------|----------------|----------------|
| Copper Alloy Waste & Scrap (a) | 160,791 | 167,121 | 204,335 | 220,405 | 234,284 |
| Canada | 26,421 | 22,628 | 23,321 | 26,023 | 33,069 |
| Mexico | 4,239 | 935 | 6,308 | 11,127 | 16,322 |
| Trinidad | -- | -- | 776 | 1,053 | 164 |
| Brazil | 401 | 4,363 | 7,037 | 649 | 1,964 |
| Venezuela | 374 | -- | 141 | 165 | 99 |
| Austria | -- | -- | 310 | -- | -- |
| Belgium | 6,960 | 6,187 | 8,019 | 9,607 | 6,466 |
| France | 227 | -- | 106 | 770 | 837 |
| Germany, F.R. | 18,814 | 5,325 | 8,513 | 23,133 | 43,927 |
| Italy | 9,804 | 21,608 | 7,177 | 2,148 | 5,458 |
| Netherlands | 4,315 | 1,644 | 885 | 1,229 | 3,347 |
| Portugal | -- | -- | -- | -- | 84 |
| Spain | 7,638 | 8,595 | 6,911 | 11,132 | 4,589 |
| Sweden | 1,994 | 2,587 | 1,763 | 1,780 | 2,319 |
| Switzerland | 713 | -- | 180 | 59 | 9 |
| United Kingdom | 2,296 | 4,486 | 2,975 | 2,974 | 6,023 |
| Yugoslavia | 132 | -- | -- | -- | -- |
| Hong Kong | 1,285 | -- | 576 | 227 | 1,581 |
| India | 15,235 | 18,254 | 13,079 | 14,533 | 28,169 |
| Japan | 27,328 | 28,317 | 26,522 | 18,988 | 20,558 |
| South Korea | 13,692 | 15,837 | 28,761 | 48,550 | 32,151 |
| Philippines | -- | -- | 126 | -- | 92 |
| Singapore | 344 | -- | 255 | 1,254 | 1,339 |
| Taiwan | 16,231 | 24,153 | 60,326 | 43,647 | 15,732 |
| Thailand | -- | -- | -- | -- | 118 |
| South Africa | -- | -- | -- | -- | 98 |
| Germany D.R. | -- | -- | -- | -- | 127 |
| China | -- | -- | 198 | 1,146 | 9,377 |
| Other Countries | 2,749 | 2,202 | 70 | 211 | 265 |

COPPER ALLOY CONTENT - SHORT TONS

| | | | | | |
|-------------------------|---------------|--------------|--------------|--------------|--------------|
| Master Alloys | 1,565 | 851 | 1,127 | 1,034 | 631 |
| Unwrought Alloys | 11,216 | 2,714 | 9,648 | 8,695 | 6,651 |

COPPER AND COPPER ALLOY EXPORTS OF BRASS MILL PRODUCTS (b)

| | | | | | |
|---------------------------------|--------|--------|--------|--------|--------|
| Strip, Sheet & Plate | | | | | |
| Copper | 1,733 | 1,414 | 1,195 | 1,903 | 7,504 |
| Copper Alloy | 15,783 | 11,375 | 16,809 | 34,526 | 18,526 |
| Foil (c) | | | | | |
| Copper & Copper Alloy | 395 | 662 | 1,125 | 5,704 | 3,694 |
| Copper | n.a. | n.a. | n.a. | n.a. | 1,069 |
| Copper Alloy | n.a. | n.a. | n.a. | n.a. | 2,625 |

continued

TABLE XV (CONT'D)

Copper Exports of the United States by Countries

Copper Alloy Content-Short Tons

| | 1985 | 1986 | 1987 | 1988 | 1989 |
|--|--------|--------|--------|---------|--------|
| Copper And Copper Alloy Exports of Brass Mill Products (cont'd) | | | | | |
| Wire | | | | | |
| Copper Alloy | 10,518 | 11,127 | 14,556 | 16,725 | 8,592 |
| Rod, Bar & Other | | | | | |
| Copper | 2,784 | 2,030 | 8,204 | 5,183 | 34,962 |
| Copper Alloy | 14,582 | 14,879 | 16,703 | 24,480 | 54,537 |
| Tube & Pipe | | | | | |
| Copper Alloy | 10,010 | 11,781 | 14,218 | 17,078 | 44,685 |
| Copper Alloy | 9,894 | 9,651 | 12,917 | 20,618 | 9,436 |
| Wire & Cable, Bare | 8,775 | 7,915 | 11,237 | 13,692 | n.a. |
| Insulated Wire & Cable (d) | 54,754 | 65,217 | 95,211 | 128,633 | n.a. |
| Building Wire & Cable | 2,265 | 2,924 | 2,852 | 3,245 | -- |
| Power Wire & Cable | 6,852 | 6,338 | 13,610 | 10,250 | -- |
| Communication Wire & Cable | 13,489 | 21,304 | 30,108 | 46,625 | -- |
| Copper Magnet Wire | 2,905 | 2,279 | 3,244 | 4,774 | -- |
| Appliance Wire & Cord | 5,950 | 6,311 | 5,189 | 8,323 | -- |
| Other Insulated Wire & Cable | 23,293 | 26,061 | 40,208 | 55,416 | -- |
| COPPER EXPORTS OF COPPER IMPORTS OF THE UNITED STATES (e) | | | | | |
| Blister & Anodes | 7 | 4 | -- | 10 | -- |
| Refined Cathodes & Shapes | 16,736 | 692 | 11 | 2,261 | 13,291 |
| Copper Waste & Scrap | 693 | 300 | 218 | 523 | 286 |
| Copper Alloy Waste & Scrap (a) | 861 | 12,531 | 8,772 | 609 | 2,184 |

Source: American Bureau of Metal Statistics Inc., U.S. Bureau of the Census.
Current monthly data available, report O11, for the above table on an annual subscription basis.

(a) Copper alloy content. (b) Thousands of pounds. (c) 1988 data combines copper and copper alloys as well as not backed and backed. 1989 separates copper alloys and includes only not backed. (d) Gross weight. (e) Copper content.
n.a. - not available at time of publication.

TABLE XVI

"COVERED EMPLOYMENT" AND WAGES IN ARIZONA COPPER MINING AND SMELTING

| <u>Year</u> | <u>Average No. Covered Employees /1</u> | <u>Total Wages</u> | <u>Average Annual Wage</u> | <u>Average Weekly Wage</u> | <u>Tons Copper Ore</u> |
|-------------|---|------------------------|------------------------------------|------------------------------------|--------------------------------|
| 1948 | 11,493 | 41,318,524 | 3,595 | 69.13 | 39,072,204 |
| 1949 | 11,001 | 40,612,224 | 3,692 | 71.00 | 37,365,611 |
| 1950 | 10,181 | 41,994,321 | 4,125 | 79.33 | 41,757,273 |
| 1951 | 10,754 | 47,825,698 | 4,447 | 85.52 | 42,784,388 |
| 1952 | 11,365 | 54,950,235 | 4,835 | 93.14 | 44,472,522 |
| 1953 | 12,068 | 62,742,982 | 5,199 | 99.98 | 45,187,838 |
| 1954 | 12,502 | 65,518,853 | 5,241 | 100.79 | 43,072,894 |
| 1955 | 12,399 | 71,293,263 | 5,750 | 110.58 | 52,189,728 |
| 1956 | 14,008 | 83,568,996 | 5,966 | 114.73 | 60,468,580 |
| 1957 | 14,652 | 85,125,320 | 5,809 | 111.71 | 59,571,834 |
| 1958 | 14,100 | 74,726,972 | 5,300 | 101.93 | 56,255,809 |
| 1959 | 11,568 | 72,095,130 | 6,232 | 119.85 | 53,121,545 |
| 1960 | 13,764 | 90,312,848 | 6,562 | 126.19 | 66,032,439 |
| 1961 | 14,275 | 97,271,286 | 6,814 | 131.04 | 71,918,991 |
| 1962 | 14,408 | 101,920,108 | 7,074 | 136.04 | 78,868,147 |
| 1963 | 14,303 | 104,291,588 | 7,292 | 140.23 | 80,615,132 |
| 1964 | 14,720 | 113,792,031 | 7,730 | 148.65 | 86,132,039 |
| 1965 | 15,239 | 122,163,124 | 8,016 | 154.16 | 92,859,535 |
| 1966 | 17,018 | 137,187,611 | 8,061 | 155.02 | 101,558,298 |
| 1967 | 13,426 | 108,427,206 | 8,076 | 155.31 | 74,289,203 |
| 1968 | 15,734 | 136,089,579 | 8,649 | 166.33 | 101,293,963 |
| 1969 | 19,459 | 173,183,018 | 8,900 | 171.15 | 127,848,828 |
| 1970 | 21,479 | 201,665,064 | 9,389 | 180.56 | 150,241,000 |
| 1971 | 21,231 | 211,978,597 | 9,984 | 192.00 | 149,294,000 |
| 1972 | 23,233 | 254,717,341 | 10,964 | 210.85 | 165,914,825 |
| 1973 | 25,494 | 291,294,328 | 11,426 | 218.89 | 181,311,945 |
| 1974 | 27,894 | 340,832,096 | 12,219 | 234.98 | 178,913,296 |

(continued)

TABLE XVI (CONT'D)

"COVERED EMPLOYMENT" AND WAGES IN ARIZONA COPPER MINING AND SMELTING

| <u>Year</u> | <u>Average No. Covered Employees (1)</u> | <u>Total Wages</u> | <u>Average Annual Wage</u> | <u>Average Weekly Wage</u> | <u>Tons Copper Ore</u> |
|-------------|--|------------------------|------------------------------------|------------------------------------|--------------------------------|
| 1975 | 25,950 | 363,349,178 | 14,002 | 269.27 | 168,750,152 |
| 1976 | 25,631 | 405,289,034 | 15,812 | 304.08 | 194,136,559 |
| 1977 | 23,373 | 398,539,789 | 16,835 | 323.75 | 168,641,401 |
| 1978 | 21,092 | 397,790,419 | 18,860 | 362.69 | 178,204,491 |
| 1979 | 23,239 | 494,963,476 | 21,299 | 409.60 | 203,997,408 |
| 1980 | 21,602 | 510,168,454 | 23,617 | 454.17 | 169,650,401 |
| 1981 | 26,031 | 687,434,789 | 26,408 | 507.85 | 216,787,430 |
| 1982 | 17,182 | 487,415,292 | 28,368 | 545.53 | 135,768,647 |
| 1983 | 13,864 | 395,266,852 | 28,510 | 548.29 | 135,301,652 |
| 1984 | 12,556 | 387,028,537 | 30,824 | 592.77 | 145,278,431 |
| 1985 | 11,155 | 349,311,047 | 31,314 | 602.19 | 174,218,218 |
| 1986 | 10,848 | 326,915,975 | 30,136 | 579.54 | 167,808,000 |
| 1987 | 10,340 | 299,297,407 | 28,946 | 556.65 | 166,113,000 |
| 1988 | 10,588 | 348,502,604 | 33,008 | 634.78 | 175,261,000 |
| 1989 | 11,111 | 383,199,684 | 34,488 | 663.23 | 196,684,000 |

(1) "Covered Employment" by law includes all employees of employers of three or more persons. Prior 1966 only a portion of the workers in smelting, refining and rod fabrication were included in this table.

Source: This report, Table XVII; "Mineral Yearbook - Area Reports: Domestic", U.S. Bureau of Mines; Research and Statistics Unit, Arizona Department of Economic Security.

TABLE XVII
ARIZONA INDUSTRIES COVERED BY UNEMPLOYMENT INSURANCE

YEAR - 1989

| <u>Industry</u> | <u>Average Number of Employees (1)</u> | <u>Total Wages</u> | <u>Average Annual Wage</u> | <u>Average Weekly Wage</u> |
|--|--|------------------------|------------------------------------|------------------------------------|
| Copper Mining | 9,482 | 328,677,070 | 34,663 | 666.60 |
| Copper Smelting, Refining & Rod Fabrication | 1,629 | 54,522,614 | 33,470 | 643.65 |
| TOTAL COPPER MINING & PROCESSING | 11,111 | 383,199,684 | 34,488 | 663.23 |
| Other Mining, Quarrying & Processing | 1,198 | 35,637,349 | 29,747 | 572.06 |
| ALL MINING, QUARRYING & PROCESSING | 12,309 | 418,837,033 | 34,027 | 654.37 |
| Mfg. Except Copper Processing | 185,769 | 5,277,827,127 | 28,411 | 546.36 |
| Construction | 86,283 | 1,863,958,365 | 21,063 | 415.44 |
| Transportation, Utilities, etc. (2) | 68,576 | 1,857,173,700 | 27,082 | 520.81 |
| Wholesale-Retail Trade | 368,774 | 5,527,423,816 | 14,989 | 288.24 |
| Services, Finance & Misc. | 462,824 | 9,314,116,355 | 20,125 | 387.00 |
| Agriculture & Related Services | 34,386 | 407,821,211 | 11,860 | 228.08 |
| Federal, State & Local Government | 246,305 | 5,839,022,377 | 23,706 | 455.89 |
| TOTAL AND AVERAGES | 1,465,226 | 30,506,179,984 | 20,820 | 400.39 |

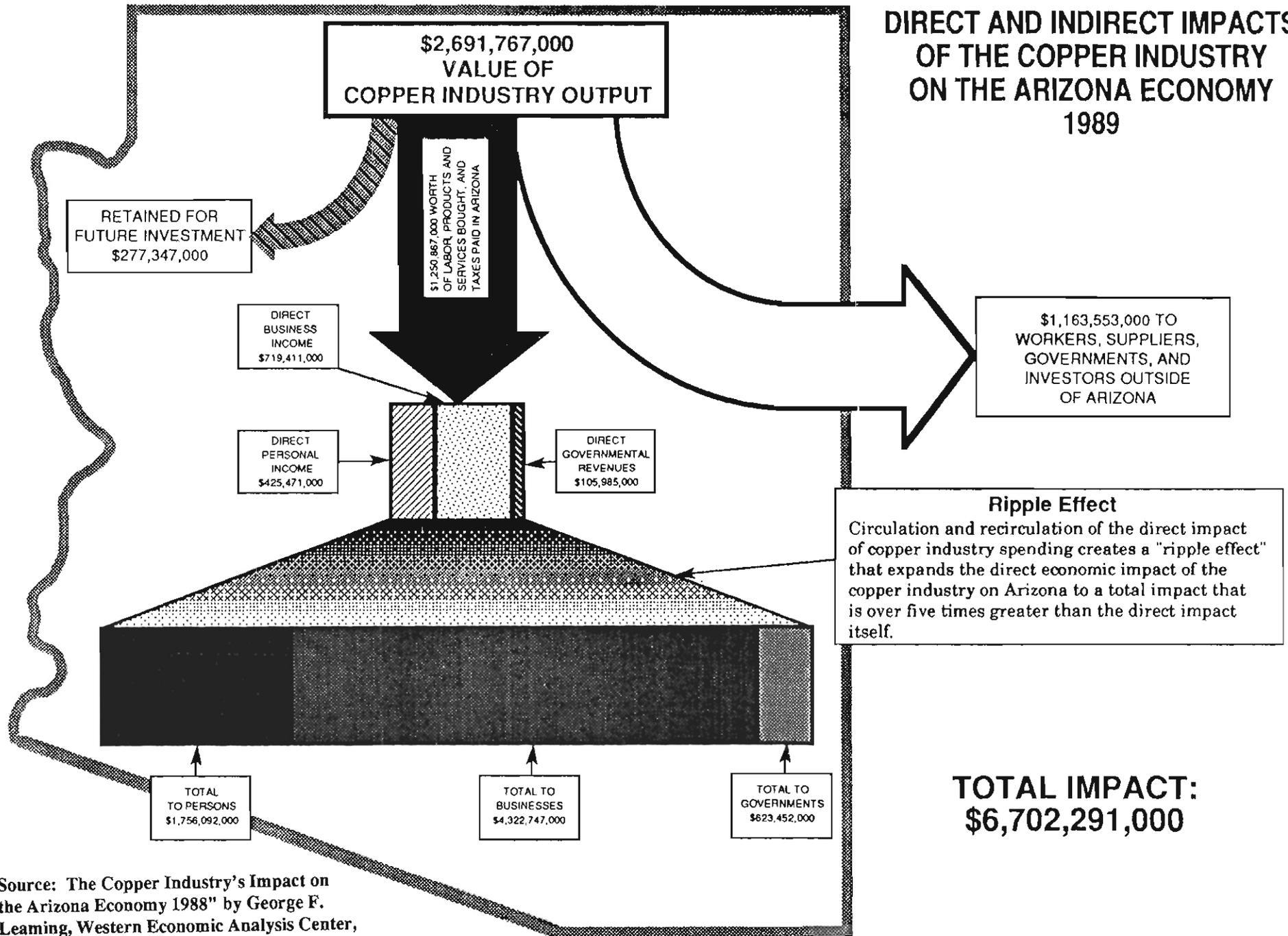
(1) Includes all covered employees.

(2) Transportation exclusive of railroads.

Source: Research Administration, Arizona Department of Economic Security

TABLE XVIII

**DIRECT AND INDIRECT IMPACTS
OF THE COPPER INDUSTRY
ON THE ARIZONA ECONOMY
1989**



Source: "The Copper Industry's Impact on the Arizona Economy 1988" by George F. Leaming, Western Economic Analysis Center, Marana, Arizona

TABLE XIX
EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING
IN THE UNITED STATES AND ARIZONA (1)

| All Employees | PRODUCTION WORKERS | | | | | | | | | | | | | |
|------------------|----------------------------|-------------|----------------------------|-------------|-------------------|-------------|-------------------|-------------|-------------------|-------------|-----------------------------|-------------|------------------------|-------------|
| | Average No. (Thousands) | | Average No. (Thousands) | | Average Weekly | | Average Weekly | | Average Hourly | | Average Earnings Per Man | | Aggregate Man Hours | |
| | (2 Ariz.) | (3 U.S.) | (4 Ariz.) | (4 U.S.) | (5 Ariz.) | (5 U.S.) | (6 Ariz.) | (6 U.S.) | (6 Ariz.) | (6 U.S.) | (7 Ariz.) | (7 U.S.) | (8 Ariz.) | (8 U.S.) |
| 1970 | 18.8 | 37.0 | 14.9 | 29.5 | 173.01 | 175.67 | 43.8 | 44.7 | 3.95 | 3.93 | 8,997 | 9,135 | 33,936 | 68,570 |
| 1971 | 18.9 | 34.7 | 14.9 | 26.8 | 178.50 | 178.46 | 42.4 | 42.9 | 4.21 | 4.16 | 9,282 | 9,280 | 32,852 | 59,785 |
| 1972 | 20.5 | 38.9 | 16.1 | 30.7 | 194.69 | 192.19 | 41.6 | 41.6 | 4.68 | 4.62 | 10,124 | 9,994 | 34,827 | 66,410 |
| 1973 | 21.5 | 42.3 | 17.6 | 33.7 | 206.75 | 206.42 | 41.6 | 42.3 | 4.97 | 4.88 | 10,751 | 10,734 | 38,072 | 74,127 |
| 1974 | 24.0 | 42.8 | 19.1 | 33.8 | 222.16 | 226.46 | 39.6 | 41.1 | 5.61 | 5.51 | 11,552 | 11,776 | 39,331 | 72,237 |
| 1975 | 22.5 | 37.1 | 17.9 | 28.4 | 247.43 | 247.14 | 38.6 | 39.2 | 6.41 | 6.33 | 12,866 | 12,903 | 35,929 | 57,891 |
| 1976 | 21.7 | 35.5 | 17.2 | 27.0 | 286.31 | 280.70 | 40.1 | 40.1 | 7.14 | 7.00 | 14,888 | 14,596 | 35,865 | 56,300 |
| 1977 | 19.3 | 35.1 | 15.3 | 26.9 | 302.99 | 288.73 | 39.4 | 38.6 | 7.69 | 7.48 | 15,755 | 15,014 | 31,347 | 53,994 |
| 1978 | 17.2 | 35.2 | 13.7 | 26.9 | 344.76 | 338.40 | 40.8 | 40.0 | 8.45 | 8.46 | 17,928 | 17,597 | 29,066 | 55,952 |
| 1979 | 19.3 | 31.9 | 15.3 | 24.6 | 404.81 | 405.03 | 42.3 | 42.5 | 9.57 | 9.53 | 21,050 | 21,061 | 33,654 | 54,366 |
| 1980 | 17.7 | 29.4 | 14.0 | 22.6 | 446.19 | 435.01 | 41.7 | 41.0 | 10.70 | 10.61 | 23,202 | 22,621 | 30,358 | 48,183 |
| 1981 | 21.9 | 36.2 | 17.4 | 27.9 | 497.28 | 492.54 | 41.2 | 41.6 | 12.07 | 11.84 | 25,859 | 25,612 | 37,278 | 60,353 |
| 1982 | 15.2 | 25.3 | 12.1 | 18.5 | 495.60 | 484.91 | 38.3 | 38.7 | 12.94 | 12.53 | 25,771 | 25,215 | 24,098 | 37,229 |
| 1983 | 11.3 | 18.9 | 9.0 | 13.5 | 519.25 | 522.69 | 39.1 | 39.9 | 13.28 | 13.10 | 27,001 | 27,180 | 18,299 | 28,010 |
| 1984 | 10.5 | 16.3 | 8.2 | 11.4 | 553.83 | 562.74 | 41.3 | 41.5 | 13.41 | 13.56 | 28,799 | 29,002 | 17,610 | 24,601 |
| 1985 | 9.4 | 13.1 | 7.5 | 9.4 | 573.80 | 574.76 | 41.4 | 42.2 | 13.86 | 13.62 | 29,838 | 29,888 | 16,146 | 20,627 |
| 1986 | 8.7 | 11.4 | 6.9 | 8.8 | 582.38 | 507.99 | 40.4 | 41.3 | 14.42 | 12.30 | 30,284 | 26,415 | 14,496 | 18,899 |
| 1987 | 8.6 | 13.5 | 6.9 | 10.7 | 556.65 | 492.20 | 40.1 | 43.1 | 13.88 | 11.42 | 28,946 | 25,595 | 14,388 | 23,981 |
| 1988 | 8.8 | 14.4 | 7.0 | 11.2 | 517.74 | 510.12 | 41.3 | 43.9 | 12.53 | 11.62 | 26,932 | 26,526 | 15,033 | 25,567 |
| 1989 | 9.5 | 14.1 | 7.5 | 11.2 | 561.26 | 540.44 | 43.4 | 45.8 | 12.94 | 11.80 | 29,186 | 28,103 | 16,926 | 26,674 |

(continued)

TABLE XIX (CONT'D)

**EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING
IN THE UNITED STATES AND ARIZONA (1)**

| Period | Copper Ore Mined (Thousand Short Tons) | | Copper Produced (Recoverable Content) (Thousand Pounds) | | Worker Productivity | | | |
|--------|---|---------|---|-----------|--|--------|---|---------|
| | Ariz. | U.S. | Ariz. | U.S. | Copper Ore Mined Per Man-Hour (Tons) | U.S. | Copper Produced Per Man-Hour (Pounds) | U.S. |
| 1970 | 150,241 | 257,729 | 1,826,734 | 3,368,957 | 4.427 | 3.759 | 53.829 | 49.132 |
| 1971 | 149,294 | 242,656 | 1,633,568 | 2,986,599 | 4.544 | 4.059 | 49.725 | 49.996 |
| 1972 | 165,815 | 266,831 | 1,816,118 | 3,264,113 | 4.761 | 4.017 | 52.161 | 49.151 |
| 1973 | 173,605 | 289,998 | 1,847,635 | 3,386,357 | 4.872 | 3.912 | 48.530 | 45.683 |
| 1974 | 178,821 | 293,443 | 1,710,744 | 3,145,148 | 4.547 | 4.062 | 43.496 | 43.539 |
| 1975 | 168,656 | 263,003 | 1,619,535 | 2,772,111 | 4.694 | 4.543 | 45.076 | 47.885 |
| 1976 | 194,046 | 283,736 | 2,043,168 | 3,166,889 | 5.410 | 5.040 | 56.968 | 56.250 |
| 1977 | 168,601 | 259,974 | 1,843,949 | 2,964,539 | 5.379 | 4.815 | 58.824 | 54.905 |
| 1978 | 178,201 | 263,722 | 1,965,072 | 2,955,210 | 6.131 | 4.713 | 67.607 | 52.817 |
| 1979 | 203,977 | 291,078 | 2,085,556 | 3,140,110 | 6.061 | 5.369 | 61.971 | 57.759 |
| 1980 | 169,650 | 241,090 | 1,669,495 | 2,527,920 | 5.588 | 5.004 | 54.994 | 52.465 |
| 1981 | 216,787 | 306,089 | 2,294,437 | 3,354,548 | 5.815 | 5.072 | 61.549 | 55.582 |
| 1982 | 146,125 | 200,589 | 1,697,500 | 2,507,070 | 6.064 | 5.388 | 70.442 | 67.342 |
| 1983 | 152,902 | 196,203 | 1,514,538 | 2,288,612 | 8.356 | 7.005 | 82.766 | 81.707 |
| 1984 | 145,278 | 189,499 | 1,583,505 | 2,405,866 | 8.250 | 7.703 | 89.921 | 97.795 |
| 1985 | 174,218 | 239,399 | 1,778,334 | 2,443,675 | 10.790 | 11.606 | 110.141 | 118.470 |
| 1986 | 167,808 | 186,105 | 1,752,525 | 2,361,127 | 11.576 | 9.847 | 120.897 | 124.934 |
| 1987 | 166,113 | 219,545 | 1,724,068 | 2,810,182 | 11.545 | 9.155 | 119.827 | 117.189 |
| 1988 | 175,261 | 246,380 | 1,885,112 | 3,168,229 | 11.658 | 9.637 | 125.398 | 123.918 |
| 1989 | 196,684 | 261,534 | 2,009,782 | 3,303,002 | 11.620 | 9.805 | 118.739 | 123.828 |

continued

TABLE XIX (CONT'D)
EMPLOYMENT, EARNINGS AND HOURS IN COPPER MINING
IN THE UNITED STATES AND ARIZONA (1

- (1) *Statistics do not reflect workers in copper smelting, refining and rod fabrication.*
- (2) *These figures are estimates made by the Arizona Department of Economic Security, in cooperation with the U.S. Bureau of Labor Statistics, and they include all full and part-time wage and salary workers who were employed in copper mining in any part of the pay periods which included the 12th of each month of the year.*
- (3) *Estimates made by the U.S. Bureau of Labor Statistics, in cooperation with the 50 states, and based upon monthly samplings similar to those in (2) above, adjusted periodically to census bench mark.*
- (4) *Estimates of production (non-supervisory) workers based upon samplings as in (2) above. Since 1975, figures have been calculated by the Arizona Department of Mines and Mineral Resources dividing the annual number of "All Employees-Arizona" by a factor of 1.26. This factor was derived by comparing the annual number of "All Employees-Arizona" with "Production Workers - Arizona" from 1970 to 1974.*
- (5) *Earnings figures for a particular year is the product of "Average Hourly Earnings" and "Average Weekly Hours" for that year.*
- (6) *Gross payroll aggregates, exclusive of irregular bonuses and other pay not earned in a sample pay period, are divided by gross man-hour aggregates of production and related workers for the period in order to determine average hourly earnings.*
- (7) *"Average Weekly Earnings" times 52 weeks.*
- (8) *Number of production workers times "Average Weekly Hours" times 52 weeks.*

Source: Table I this publication, American Bureau of Metal Statistics, Research and Statistics Unit, Arizona Department of Economic Security: "Mineral Yearbook - Metals, Minerals", U.S. Bureau of Mines. Employment and Earnings", U.S. Dept. of Labor, Bureau of Labor Statistics, March issues, U.S. Dept. of Interior.

Figure 3. COPPER PRODUCED
(RECOVERABLE CONTENT IN POUNDS)*

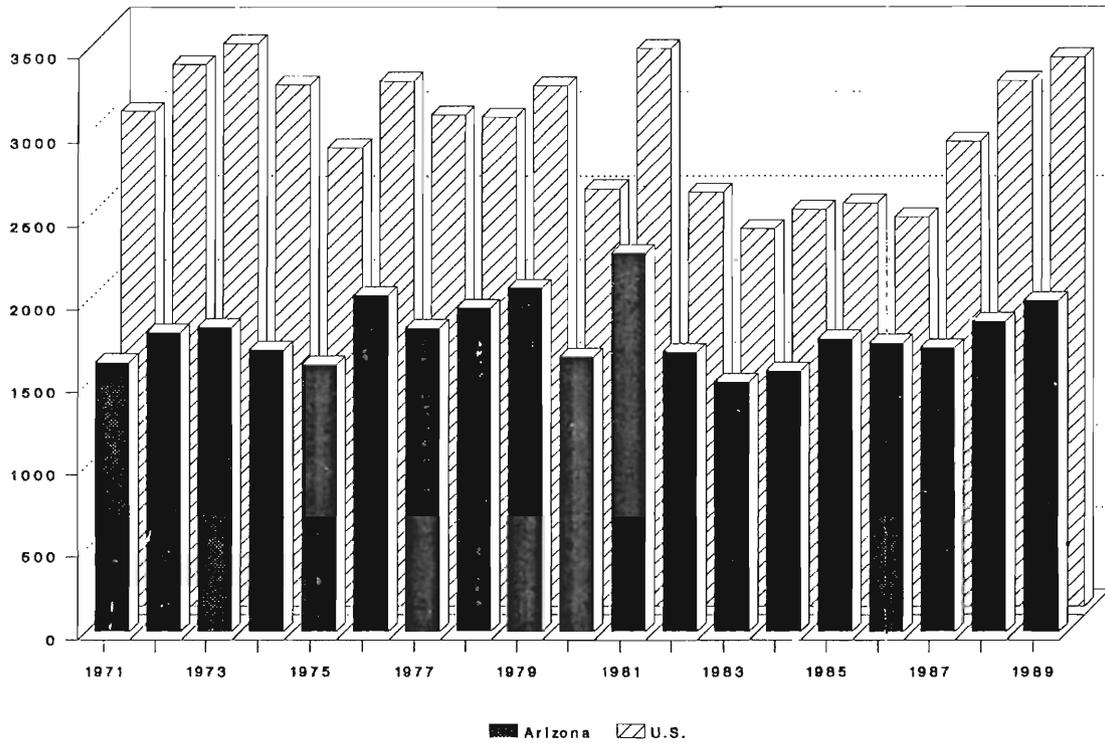
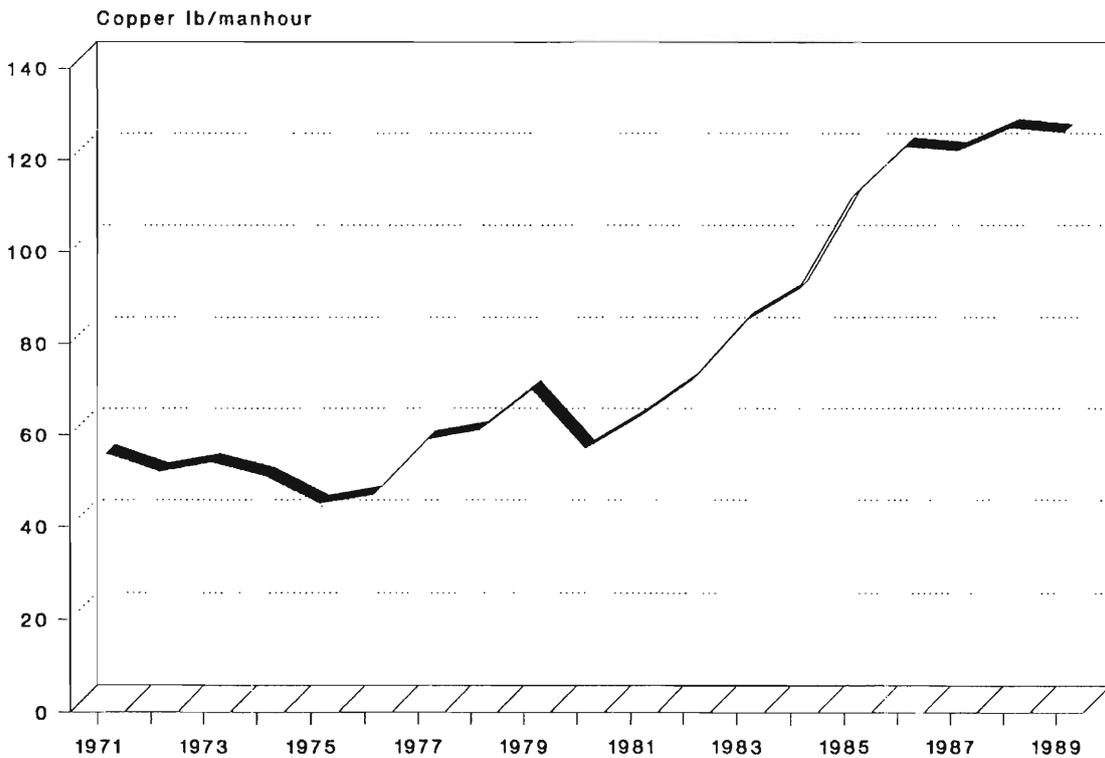


FIGURE 4. PRODUCTIVITY OF ARIZONA
COPPER WORKERS *



* From Table XIX

TABLE XX

**REFINED COPPER INVENTORIES AT YEAR END
AMOUNTS IN THOUSANDS OF SHORT TONS**

| Where Held | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|------------------------------|--------------|--------------|--------------|--------------|--------------|----------------------|
| U.S. refineries | 193.4 | 150.4 | 145.1 | 63.1 | 42.9 | 38.4 ^(a) |
| Comex warehouses | 276.3 | 120.3 | 93.3 | 18.3 | 13.4 | 15.1 ^(b) |
| Total U.S. | 469.7 | 270.7 | 238.4 | 81.4 | 56.3 | 53.5 |
| Refineries elsewhere | 285.7 | 293.7 | 280.6 | 202.6 | 265.0 | 284.6 ^(c) |
| LME warehouses | 139.3 | 209.1 | 193.1 | 58.3 | 72.5 | 108.6 ^(d) |
| Total elsewhere | 425.0 | 502.8 | 473.7 | 260.9 | 327.4 | 393.2 |
| Aggregate inventories | 894.7 | 773.5 | 712.1 | 342.3 | 383.7 | 446.7 |

Source: American Bureau of Metal Statistics as reported in E&MJ. All figures for December 31, 1987.

(a) As of November 30, 1989.

(b) As of December 22, 1989.

(c) As of October 31, 1989.

(d) As of December 15, 1989.

TABLE XXI
**AVERAGE QUOTED PRICE OF
 ELECTROLYTIC COPPER WIREBAR
 DOMESTIC, DELIVERED**

U.S. ¢/lb. ⁽¹⁾

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|-----------|---------|--------|--------|--------|--------|--------|--------|---------|---------|---------|
| JANUARY | 119.385 | 88.570 | 78.634 | 80.219 | 68.792 | 64.487 | 69.881 | 64.986 | 132.496 | 152.770 |
| FEBRUARY | 133.808 | 86.071 | 78.779 | 84.024 | 70.748 | 66.446 | 68.253 | 65.525 | 105.025 | 140.211 |
| MARCH | 106.040 | 87.382 | 75.862 | 82.072 | 75.311 | 65.547 | 70.144 | 68.071 | 109.720 | 148.492 |
| APRIL | 94.851 | 88.033 | 76.273 | 83.493 | 77.388 | 70.318 | 68.801 | 67.129 | 103.641 | 143.486 |
| MAY | 93.479 | 85.798 | 77.948 | 85.634 | 72.229 | 69.864 | 67.082 | 70.985 | 104.373 | 127.146 |
| JUNE | 92.713 | 85.226 | 71.488 | 81.836 | 69.849 | 67.094 | 67.471 | 74.346 | 114.275 | 115.901 |
| JULY | 103.565 | 84.412 | 71.053 | 82.947 | 64.402 | 66.773 | 63.815 | 80.419 | 104.848 | 113.487 |
| AUGUST | 100.708 | 87.387 | 70.999 | 80.542 | 64.535 | 66.284 | 62.374 | 82.183 | 101.451 | 127.430 |
| SEPTEMBER | 98.864 | 84.722 | 71.065 | 77.587 | 63.408 | 65.716 | 64.844 | 85.607 | 116.120 | 138.439 |
| OCTOBER | 99.471 | 82.312 | 72.413 | 73.392 | 62.039 | 66.680 | 63.464 | 88.253 | 138.048 | 131.659 |
| NOVEMBER | 96.982 | 81.216 | 72.968 | 69.581 | 65.650 | 66.294 | 62.855 | 108.528 | 152.320 | 118.109 |
| DECEMBER | 89.127 | 80.293 | 74.230 | 70.805 | 63.538 | 68.025 | 63.630 | 133.339 | 161.270 | 109.216 |

(1 MW US Producer Delivered.

Source: Metals Week.

Prepared by: State of Arizona Joint Legislative Budget Committee Staff.

TABLE XXII

AVERAGE COPPER CASH PRODUCTION COSTS FOR THE UNITED STATES, 1983-88 (1)

(Cents per pound of copper)

| PRODUCT COSTS | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 |
|-----------------------------|-------------|-------------|------------|------------|-------------|-------------|
| Mine op. cost | 22 | 20 | 23 | 23 | 19 | 18 |
| Mill-Float op. cost (2) | 24 | 23 | 20 | 21 | 28 | 28 |
| Mill-Leach op. cost | 7 | 7 | | | | |
| Smelt/Refine/Transportation | 26 | 24 | 23 | 19 | 14 | 17 |
| Taxes (3) | 3 | 2 | 2 | 2 | 2 | 1 |
| Total Cost | 82 | 76 | 68 | 65 | 63 | 64 |
| Byproduct Credits | (13) | (11) | (9) | (9) | (10) | (10) |
| Cash Cost (4) | 69 | 65 | 59 | 56 | 53 | 54 |
| Recovery of Capital | | | | 11 | 5 | 7 |
| TOTAL | | | | 67 | 58 | 61 |

(1) Includes 18 mines, most of which were producing from 1983 to 1988.

(2) Includes copper recovered by leaching in 1985 et.seq.

(3) Property and severance taxes and royalties, if applicable.

(4) Includes all cash cost of production and credit for byproducts but excludes depreciation and profit. Costs are in actual dollars for each year shown.

Source: U.S. Bureau of Mines Mineral Yearbook, Volume 1 - Metals & Minerals.

TABLE XXIII

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|---|----------------------------|-----------------------|---------------------|-----------------------|---|
| ANTLER T17N R16W Sec 4 | Standard Metals Corp. | Sulfide | 5 | 1.95 | With 4.13% Zn, 0.94% Pb, and 1.05 Ag oz/ton. Annual Report & Form 10-K, 1987. An additional 2.5 million tons reported in 1979 Annual Report. |
| ATLAS T11S R8E Sec 32 | Asarco | Sulfide | 5 | 0.64 | Report on the BS&K Project, Pima Co., AZ" by Frank H. Buchella. Cutoff at 0.40% Cu |
| | | Acid Soluble | 5 | 0.37 | Cutoff at 0.20% Cu. |
| | | Sulfide | 19 | 0.66 | Asarco property adjacent to Atlas. |
| | | Acid Soluble | 12 | 0.38 | Asarco property adjacent to Atlas. |
| BAGDAD T14N R9W Sec 4 | Cyprus Minerals Co. | Sulfide | 708 | 0.42 | With 0.021% Mo. (includes acid soluble) Form 10-K, 1989. |
| BUCKEYE EAST T3S R12E Sec 26 | Asarco Inc. | Acid Soluble | 22 | 0.65 | AZ Mining Assoc. "AZ Wilderness 1988" Report A-23 to Congress. |
| CACTUS T1N R13E Sec 36 | Magma Copper Co. | Mixed | 10 | 0.70 | Cactus Prospect Report. Cutoff at 0.2% Cu |
| CARLOTA T1N R13E Sec 36 | Owens, S.B. | Acid Soluble | 4 | 0.85 | Reported 1979. |
| CASA GRANDE T6S R5E Sec 18 | Asarco Freeport McMoran | Mixed | 352 | 1.00 | Getty Oil Co. Annual Report, 1980. With 0.01% Mo. Cutoff at 0.5% Cu. |
| CHILITO T4S R15E Sec 22 | Asarco Inc. | Mixed | 75 | 0.51 | Chilito Mines Report. With 0.01% Mo, 0.04 oz Ag. |
| CHRISTMAS (OP) CHRISTMAS (UG) T4S R16E Sec 30 | Cyprus Minerals Co. | Sulfide | 7 | 0.63 | Inspiration Resources Form 10-K, 1983 |
| | | Sulfide | 20 | 1.82 | (same as above) |

continued

TABLE XXIII (CONT'D)

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|-------------------------------------|--------------------------|--------------------|------------------|--------------------|---|
| COCHISE T23S R24E Secs 9 & 10 | Phelps Dodge Corp. | Acid Soluble | 170 | 0.50 | Annual Report, 1987. |
| COPPER BASIN T13N R3W Sec 20 | Phelps Dodge Corp. | Sulfide | 175 | 0.55 | With 0.021% Mo. Phelps Dodge Annual Report 1989. |
| COPPER BUTTE T3S R13E Sec 30 | Asarco Inc. | Acid Soluble | 22 | 1.09 | AZ Mining Assoc. "AZ Wilderness 1988" Report A-23 to Congress. |
| COPPER CREEK T8S R18E Sec 11 | Magma Copper Co. | Sulfide | 80 | 0.55 | Old copper reserves data. |
| COPPER QUEEN T23S R24E Sec 9 | Phelps Dodge Corp. | Mixed | 1 | 5.50 | Underground. Phelps Dodge Prospectus May 8, 1975. |
| DOS POBRES T5S R26E Sec 27 | Phelps Dodge Corp. | Sulfide | 232 | 0.89 | Form 10-K, 1989, page 7. |
| DRAGOON T16S R22E Sec 25 | Sullivan, James | Acid Soluble | 25 | 0.50 | 0.5 to 0.6 acid soluble copper. |
| DYNAMITE T17S R13E Sec 30 | Smith, V.A. - Estate | Mixed | 100 | 0.53 | Unpublished estimate. |
| EMERALD ISLE T23N R18W Sec 22 | Arimetco | Acid Soluble | 2 | 0.72 | Arimetco International, Inc. prospectus May 16, 1990 |
| ESPERANZA T18S R12E Sec 16 | Cyprus Minerals Co. | Sulfide | 48 | 0.27 | With 0.034% Mo. Pennzoil Form 10-K, 1981. |
| FOUR METALS T23S R16E Sec 20 | Dore Mining & Milling | Sulfide | 3 | 0.82 | Iso Mines Ltd. Annual Report, 1965. |

continued

TABLE XXIII (CONT'D)

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|--|---------------------------|---|---------------------|-----------------------|--|
| GIBSON T1S R14E Sec 21 | Lodestar Minerals Inc. | Acid Soluble | 11 | 0.7 | 43 million tons at 0.40% Cu. Fletcher, J.B. et al report Aug. 1984. |
| HELVETIA T18S R15E Sec 36 | Asarco Inc. | Sulfide Acid Soluble | 337 22 | 0.54 0.55 | With Sulfide - 0.088 oz/ton Ag, 0.0005 oz/ton Au. |
| I-10 T15S R23E Sec 31 | Cyprus Minerals Co. | Mixed | 100 | 0.52 | Unpublished estimate; with 0.02% Mo. |
| INSPIRATION AREA MINES T1N R14E Sec 25 | Cyprus Minerals Co. | Acid Soluble | 252 | 0.43 | Cyprus Minerals Co. Form 10K, 1989 Acquired by Cyprus from Inspiration July 1, 1988. |
| IRON DOOR T13S R25E Sec 17 | Unknown | Sulfide | 63 | 0.38 | Spike-E Hills Report. Cutoff at 0.20% Cu. |
| JOHNSON T15S R22E Sec 26 | Arimetco | Sulfide Acid Soluble | 9 26 | 0.60 0.29 | Arimetco International Inc. prospectus May 16, 1990 |
| KALAMAZOO T9S R16E Sec 9 | Magma Copper Co. | Sulfide Sulfide shaft pillar | 211 101 | 0.77 0.68 | Form 10-K, 1987. |
| KORN KOB T12S R17E Sec 14 | Keystone Minerals Inc. | Acid Soluble | 2 8 | 0.53 0.44 | North Ore Body. South Ore Body. Holmes & Narrou report on Korn Kob, March 1974 section 5. |
| LAKESHORE T10S R4E Sec 25 | Cyprus Minerals Co. | Sulfide (Porphyry) Sulfide (Tactite) Acid Soluble | 41 9 16 | 0.71 1.35 0.77 | Noranda Annual Report, 1984. Noranda Annual Report, 1984. Cyprus Minerals Form 10K 1989 |

continued

TABLE XXIII (CONT'D)

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|-------------------------------------|---------------------------------|-----------------------|---------------------|-----------------------|---|
| LONE STAR T6S R27E Sec 5 | Phelps Dodge Corp. | Mixed | 1000 | 0.41 | Phelps Dodge Form 10-K, 1988. |
| MAGMA MINE T1S R12E Sec 35 | Magma Copper Co. | Sulfide | 5 | 5.52 | Currently targeted reserves-1.7 million tons at 6.8% Cu with 5% cut-off. Southwestern Pay Dirt "March, 1990 pgs. 4A-6 |
| MAME T19S R25E Sec 20 | Hope Mining & Milling Co. | Acid Soluble | 1 | 1.10 | Unpublished estimate. |
| MIAMI EAST T1N R15E Sec 19 | Magma Copper Co. | Sulfide Sulfide | 6 50 | 3.14 1.95 | Newmont Mining Annual Report, 1985. Minerals Yearbook 1973, VII Area Rpts USF |
| MIAMI TAILINGS T1N R15E Sec 30 | Magma Copper Co. | Acid Soluble | 35 | 0.33 | Magma Form 10-K, 1988. Expect 54% recovery. |
| MINERAL BUTTE T4S R7E Sec 1 | Berry, Julian | Mixed | 15 | 0.42 | Cutoff at 0.32% Cu. Bear Creek report. |
| MINERAL PARK T23N R17W Sec 19 | Cyprus Minerals Co. | Sulfide | 35 | 0.17 | With .054% Mo. Pennzoil Form 10-K, 1981. |
| MISSION COMPLEX T16S R12E Sec 31 | Asarco Inc. | Sulfide | 333 | 0.67 | With 0.13 oz/ton Ag. Asarco Annual Report, 1989. |
| MORENCI/METCALF T4S R29E Sec 16 | Phelps Dodge 85% & Sumitomo 15% | Sulfide Sulfide | 707 150 | 0.79 0.72 | Phelps Dodge Form 10K 1989 Western Copper |
| NEW CORNELIA T12S R6W Sec 27 | Phelps Dodge Corp. | Sulfide | 209 | 0.50 | Phelps Dodge Form 10-K, 1988. |
| ORACLE RIDGE T11S R16E Sec 16 | Southern Atlantic Ventures Ltd. | Mixed | 4 | 2.23 | With 0.67 oz/ton Ag. Additional possible reserves of 4.4 million tons at 2.25% Cu E&MJ - June 1989, pg. 89 |

continued

TABLE XXIII (CONT'D)

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|---|--------------------|-----------------------|---------------------|-----------------------|--|
| PEACH ELGIN T18S R15E Sec 15 | Asarco Inc. | Sulfide | 14 | 0.78 | West, Barbara J. report, January 1980. |
| | | Acid Soluble | 10 | 0.75 | |
| PINTO VALLEY T1N R14E Sec 2 | Magma Copper Co. | Sulfide | 404 | 0.39 | Magma Form 10-K, 1988. *Outside of current mine plan. |
| | | Sulfide | 317 | 0.39 | |
| POSTON BUTTE T4S R9E Sec 33 | Conoco Inc. | Mixed | 800 | 0.40 | Copper Studies Inc., NYC, March 30, 1979. 500 million tons at 0.50% TCu from Conoco Annual Report, 1972. |
| RAY T3S R13E Sec 10 | Asarco Inc. | Sulfide | 642 | 0.69 | Asarco Annual Report, 1989. |
| RED MOUNTAIN T22S R16E Sec 20 | Kerr McGee Corp. | Sulfide | 100 | 0.71 | Tucson Daily Citizen, Sept. 23, 1970. |
| SACATON EAST (UG) T5S R5E Sec 26 | Asarco Inc. | Sulfide | 15 | 1.25 | Asarco Inc. Form 10K, 1979. |
| SAN JUAN T5S R26E Sec 35 | Claridge, Alf | Acid Soluble | 16 | 0.52 | Cutoff at 0.35% Cu or 20 million tons at lower grade with lower cutoff. Producers Minerals corp. Rpt. June 1975. |
| SAN MANUEL T8S R16E Sec 34 | Magma Copper Co. | Sulfide | 109 | 0.73 | Magma form 10K, 1988. Cutoff at 0.50% Cu. *Not in current mine plan. |
| | | *Sulfide | 143 | 0.64 | |
| SAN MANUEL OPEN PIT T8S R16E Sec 35 | Magma Copper Co. | Acid Soluble | 49 | 0.42 | Open Pit. Open Pit Marginal. In Situ. Magma Prospectus 1989. |
| | | Acid Soluble | 11 | 0.14 | |
| | | Acid Soluble | 261 | 0.35 | |
| | | Sulfide | 3 | 0.90 | |
| SANCHEZ T6S R27E Sec 25 | Arizona Copper Co. | Acid Soluble | 168 | 0.34 | "S.W. Pay Dirt", June 1989. |

continued

TABLE XXIII (CONT'D)

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|--|-----------------------------------|-------------------------|---------------------|-----------------------|--|
| SANTA CRUZ T6S R4E Sec 13 | Freeport McMoran & Asarco | Acid Soluble | 800 | 0.43 | 50% joint venture with Asarco. USBM data 1985. |
| SHEEP MOUNTAIN PROPERTY T8N R2W Sec 13 | Mongeau, Ray | Sulfide | 350 | 1.00 | To 500 tons, copper content approx. Unpublished estimate. |
| SIERRITA T18S R12E Sec 7 | Cyprus Minerals Co. | Sulfide | 563 | 0.34 | With .037% Mo. Cyprus Minerals Co. Form 10-K, 1989. Reserve estimates include Twin Buttes. |
| SILVER BELL T12S R8E Sec 11 | Asarco Inc. | Sulfide | 101 | 0.47 | With 0.01 oz/ton Ag. Asarco Annual Report, 1989. |
| SQUAW PEAK T13N R5E Secs 29 & 30 | Squaw Peak Copper May 16, 1990 | Sulfide | 20 | 0.36 | Roe, Robert R., 1976 report. |
| STRAY ELEPHANT T4N R20W Sec 31,32 | Heinrichs GEO Exploraton Co. | Acid Soluble | 4 | 0.36 | Potential of 13 million tons at 0.50% ASCO 1989 report by James Loughry. |
| STRONG & HARRIS T15S R22E Sec 13 | Duram, A. et.al | Mixed | 60 | 0.60 | Unpublished estimate with 0.70 Zn. |
| TURQUOISE T19S R25E Sec 17 | Santa Fe Mining | Acid Soluble | 15 | 1.50 | .05 oz/ton Au. Northern Miner, June 4, 1990. |
| TWIN BUTTES T18S R13E Sec 5 | Cyprus Sierrita | Sulfide Acid Soluble | | | Cyprus Minerals Co., Form 10-K, 1989 39 million tons @ 1.00% 11 million tons @0.73% |

continued

TABLE XXIII (CONT'D)

COPPER RESERVE BASE IN ARIZONA (1)

| DEPOSIT | COMPANY | MAJOR MINERAL TYPE | MILLIONS OF TONS | AVERAGE Cu CONTENT | REMARKS/SOURCE |
|---------------------------------|---------------------|--------------------|------------------|--------------------|---|
| UNITED VERDE T16N R2E Sec 22 | Phelps Dodge | Sulfide | 21 | 0.52 | USGS 1857 D. |
| VAN DYKE T1N R15E Sec 30 | Arimetco | Acid Soluble | 100 | 0.50 | Mining Engineering, Dec. 1977. |
| VEKOL HILLS T10S R3E Sec 4 | Tohono O'odham | Sulfide | 105 | 0.56 | With 0.014% Mo, 16 million tons acid soluble Cu. Final EIS, Vekol Hills Project, US Dept of Interior, Bureau of Indian Affairs, May 1988. |
| VENTURA T23S R15E Sec 1 | Cyprus Minerals Co. | Sulfide | 6 | 0.26 | Iso Mines Ltd. Annual Report, 1965. With 0.28% MoS (6 million additional tons possible) |
| WHITE MESA T38N R9E Sec 29 | Navajo Tribe | Acid Soluble | 2 | 0.75 | Mayo, E.B., 1955 report. |
| ZONIA T11N R4W Sec 12 | Zonia Co. | Acid Soluble | 35 | 0.31 | Lundin, Richard J. et al, Feb. 1985 rpt. |

TOTAL COPPER RESERVE BASE IN ARIZONA

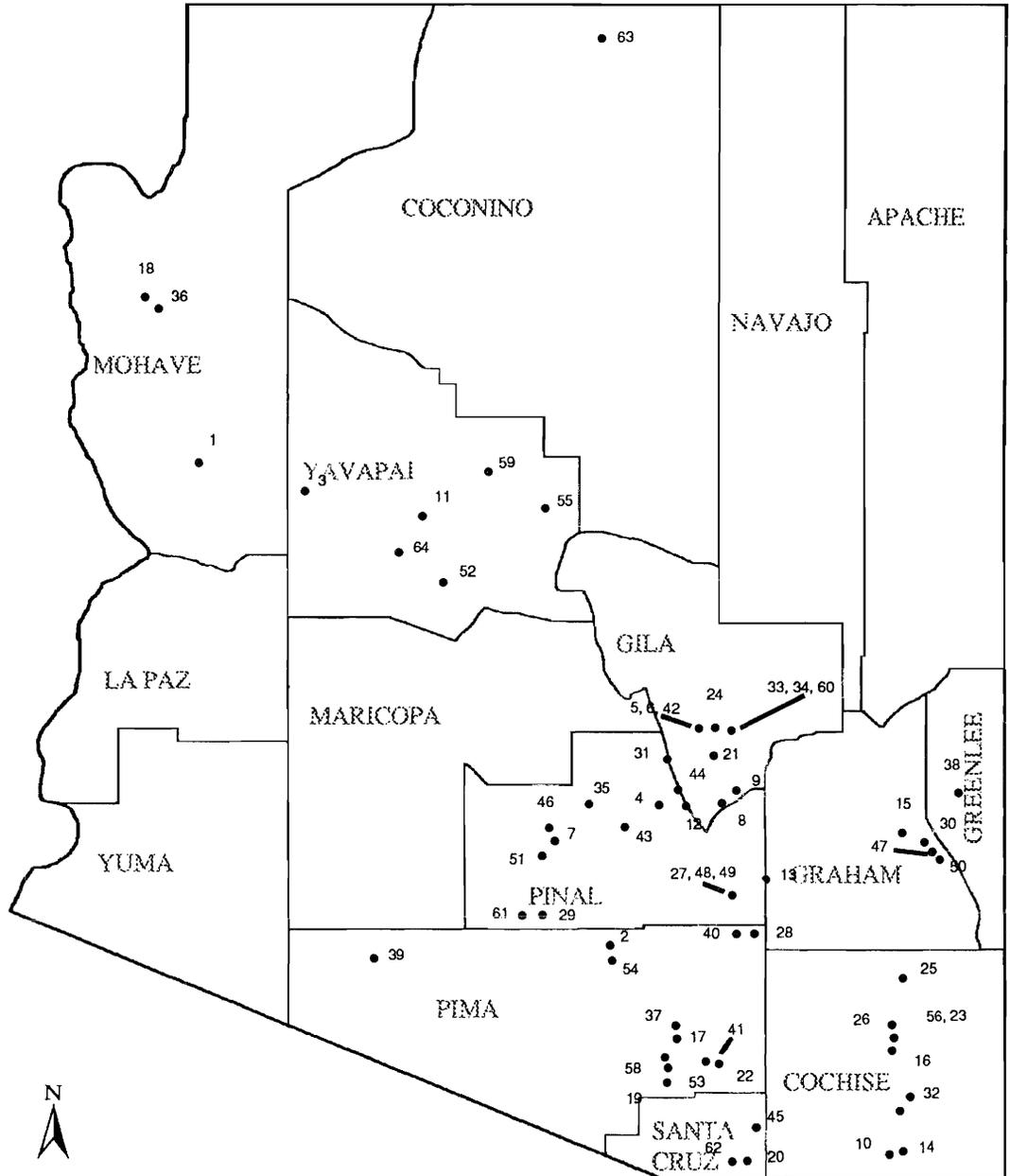
Sulfide 6.5 Billion Tons at 0.62% Cu
 Acid Soluble 2.1 Billion tons at 0.44% Cu
 Mixed 2.5 Billion tons at 0.52% Cu
 TOTAL 11.1 Billion tons at 0.56% or 62 million tons of copper

(1 Reserve Base - That part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices, including those for grade, quality, thickness, and depth. The reserve base is the in-place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources).

"Mineral Facts and Problems" 1985 Edition, Bureau of Mines Bulletin 675, page 3.

Figure 5. COPPER RESERVES, 1989

1. Antler
2. Atlas
3. Bagdad
4. Buckeye East
5. Cactus
6. Carlota
7. Casa Grande
8. Chilito
9. Christmas
10. Cochise
11. Copper Basin
12. Copper Butte
13. Copper Creek
14. Copper Queen
15. Dos Pobres
16. Dragoon
17. Dynamite
18. Emerald Isle
19. Esperanza
20. Four Metals
21. Gibson
22. Helvetia
23. I-10
24. Inspiration Area Mines
25. Iron Door
26. Johnson
27. Kalamazoo
28. Kom Kob
29. Lakeshore
30. Lone Star
31. Magma Mine
32. Mame
33. Miami East
34. Miami Tailings
35. Mineral Butte
36. Mineral Park
37. Mission Complex
38. Morenci/Metcalf
39. New Comelia
40. Oracle Ridge
41. Peach Elgin
42. Pinto Valley
43. Poston Butte
44. Ray
45. Red Mountain
46. Sacaton East (UG)
47. San Juan
48. San Manuel
49. San Manuel Open Pit
50. Sanchez
51. Santa Cruz
52. Sheep Mountain Property
53. Sierrita
54. Silver Bell
55. Squaw Peak
56. Strong & Harris
57. Turquoise
58. Twin Buttes
59. United Verde
60. Van Dyke
61. Vekol Hills
62. Ventura
63. White Mesa
64. Zonia



COPPER RESERVES - INDEX BY COMPANY

| Company | Deposit | Company | Deposit |
|---------------------------|-------------------|----------------------------|---------------------|
| Arimetco | Emerald Isle | Magma Copper Co. | San Manuel Open Pit |
| Arimetco | Van Dyke | Navajo Tribe | White Mesa |
| Asarco Inc. | Atlas | Owens, S.B. | Carlota |
| Asarco Inc. | Buckeye East | Phelps Dodge Corp. | Cochise |
| Asarco Inc. | Chilito | Phelps Dodge Corp. | Copper Basin |
| Asarco Inc. | Copper Butte | Phelps Dodge Corp. | Copper Queen |
| Asarco Inc. | Helvetia | Phelps Dodge Corp. | Dos Pobres |
| Asarco Inc. | Peach Elgin | Phelps Dodge Corp. | Lone Star |
| Asarco Inc. | Mission | Phelps Dodge Corp. | Morenci/Metcalf |
| Asarco Inc. | Ray | Phelps Dodge Corp. | New Cornelia |
| Asarco Inc. | Sacaton East (UG) | Rayrock Mines | Kay Copper Mine |
| Asarco Inc. | Silver Bell | Santa Fe Mining | Turquoise |
| Casa Grande Copper Co. | Casa Grande | Smith, Ken P. et al | Sheep Mountain |
| CF & I Steel Corp. | Dragoon | Smith, V.A. estate | Dynamite |
| Cochise Mining Corp. | San Juan | Southern Atlantic Ventures | Oracle Ridge |
| Conoco Inc. | Poston Butte | Squaw Peak Copper | Squaw Peak |
| Cyprus Minerals Co. | Christmas | Standard Metals | Antler |
| Cyprus Minerals Co. | Bagdad | Tohono O'odham Tribe | Vekol Hills |
| Cyprus Minerals Co. | Esperanza | Unknown | Iron Door |
| Cyprus Minerals Co. | I-10 | Unknown | Mineral Butte |
| Cyprus Minerals Co. | Inspiration Area | Zonia Co. | Zonia |
| Cyprus Minerals Co. | Lakeshore | | |
| Cyprus Minerals Co. | Mineral Park | | |
| Cyprus Minerals Co. | Sierrita | | |
| Cyprus Minerals Co. | Twin Buttes | | |
| Cyprus Minerals Co. | Ventura | | |
| Dore Mining & Milling | Four Metals | | |
| Durham, A. et al | Strong & Harris | | |
| Freeport McMoran | Santa Cruz | | |
| Harpoon, Inc. | Sanchez | | |
| Hope Mining & Milling Co. | Mame | | |
| Kerr McGee Corp. | Red Mountain | | |
| Keystone Minerals | Korn Kob | | |
| Lodestar Minerals Inc. | Gibson | | |
| Magma Copper Co. | Cactus | | |
| Magma Copper Co. | Copper Creek | | |
| Magma Copper Co. | Kalamazoo | | |
| Magma Copper Co. | Magma Mine | | |
| Magma Copper Co. | Miami East | | |
| Magma Copper Co. | Miami Tailings | | |
| Magma Copper Co. | Pinto Valley | | |
| Magma Copper Co. | San Manuel | | |

TABLE XXIV

ARIZONA AND U.S. COPPER MINE PRODUCTION IN SHORT TONS OF Cu, 1874-1989

| Period | AZ Production (1 | Cumulative AZ | U.S. Production (1 | Cumulative U.S. | AZ % of U.S. Prod. | |
|------------|------------------|---------------|--------------------|-----------------|--------------------|------|
| | | | | | Ann'l | Cum |
| 1874-1971* | | 24,889,171 | | 60,365,183 | | 41.2 |
| 1972 | 847,929 | 25,737,100 | 1,664,840 | 62,030,023 | 50.9 | 41.5 |
| 1973 | 867,506 | 26,604,606 | 1,717,940 | 63,747,963 | 50.5 | 41.7 |
| 1974 | 804,904 | 27,409,510 | 1,597,002 | 65,344,965 | 50.4 | 41.9 |
| 1975 | 751,489 | 28,160,999 | 1,413,366 | 66,758,331 | 53.2 | 42.2 |
| 1976 | 956,215 | 29,117,214 | 1,605,586 | 68,363,917 | 60.0 | 42.6 |
| 1977 | 852,620 | 29,969,834 | 1,503,964 | 69,867,887 | 56.7 | 42.9 |
| 1978 | 908,835 | 30,878,669 | 1,496,482 | 71,364,363 | 60.7 | 43.3 |
| 1979 | 957,251 | 31,835,920 | 1,591,200 | 72,955,563 | 60.2 | 43.6 |
| 1980 | 760,926 | 32,596,846 | 1,301,900 | 74,257,463 | 58.4 | 43.9 |
| 1981 | 1,071,949 | 33,668,795 | 1,695,500 | 75,952,963 | 63.2 | 44.3 |
| 1982 | 848,750 | 34,517,545 | 1,264,322 | 77,217,285 | 67.1 | 44.7 |
| 1983 | 747,604 | 35,265,149 | 1,144,306 | 78,361,591 | 65.3 | 45.0 |
| 1984 | 822,815 | 36,087,964 | 1,215,400 | 79,576,991 | 67.7 | 45.3 |
| 1985 | 878,044 | 36,966,008 | 1,218,900 | 80,795,891 | 72.0 | 45.8 |
| 1986 | 878,926 | 37,844,934 | 1,180,564 | 81,976,455 | 74.4 | 46.2 |
| 1987 | 862,034 | 38,706,968 | 1,384,394 | 83,360,849 | 62.3 | 46.4 |
| 1988 | 942,556 | 39,649,524 | 1,584,115 | 84,944,964 | 59.5 | 46.7 |
| 1989 | 1,004,891 | 40,654,415 | 1,651,501 | 86,596,465 | 60.8 | 46.9 |

* For Cumulative Breakdown 1874-1911 and Annual Production 1912-1971, see "The Copper Industry" by Ken Phillips, published Feb. 1973 by ADMMR.

(1 Source: "Mineral Yearbook - Area Reports: Domestic", U.S. Bureau of Mines and Table I this report.

THE ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

The objective of the Department is to promote the development of Arizona's mineral resources. This is accomplished through technical research, field investigations, compilation of information into a mineral occurrence data base and disseminating information through publications, personal contacts and seminars.

The Department's mining engineers and geologists assist mining and exploration companies, prospectors and others interested in Arizona's minerals with mineral processing, mineral land acquisition, exploration, mine development, financing, government regulations and marketing.

The Department is a service agency and does not regulate, tax, or require any type of registration. The agency provides assistance that is tailored to meet the differing needs of the public. The following is a partial list of services which the Department offers:

- Maintain a site specific data base of unpublished reports and maps which includes 5,000 mine files and indexes of 10,000 computerized Arizona
- Maintain an information bank and library of mineral and mining information including a mine map library (hard copy and microfilm), government publications, periodicals, and unpublished master and doctorate theses.
- Gather and disseminate information on commodities and markets.
- Suggest target areas for possible exploration activity.
- Suggest prospects and individual properties for study and acquisition.
- Assist individuals and companies in their dealings with State regulatory agencies to facilitate their mining and exploration activity.
- Produce publications in the form of mineral reports, annual directories, technical reports, annual mineral industry surveys and information circulars. These include Laws and Regulations Governing Mineral Rights in Arizona, Directory of Active Mines in Arizona, Manual for Determination of Status and Ownership of Arizona Mineral and Water Rights, and others. A current listing of the Department publications is available upon request.